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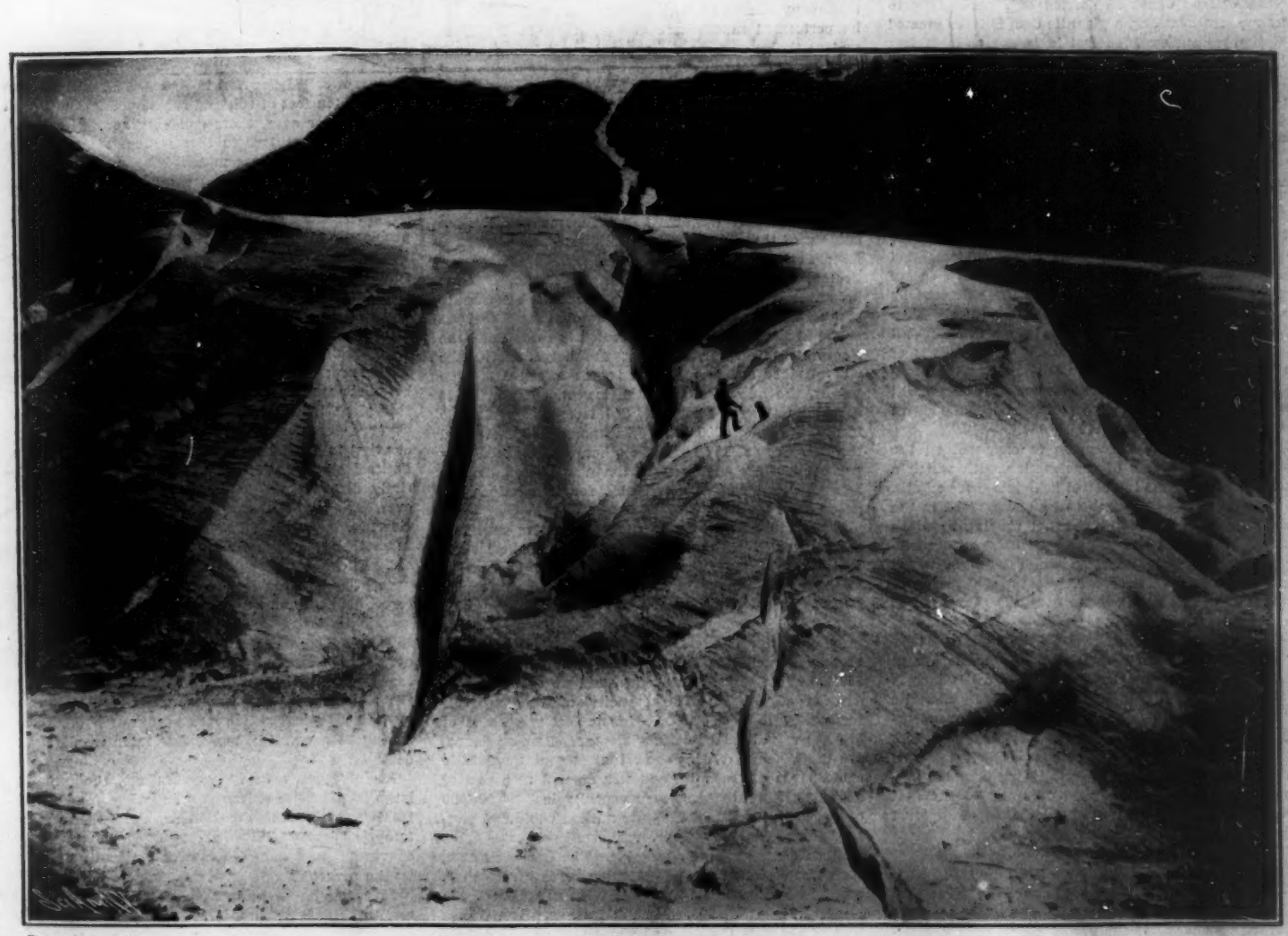
A Scientific Party Making Observations on a Glacier Moraine.

It is the business of these men to survey the glacier by means of the usual methods employed in civil engineering and to determine its rate of movement and its depth. Stakes are driven in the ice and their change of position noted.

General View of Mount Tacoma.

Great Nisqually glacier shown just below the summit and at the right of it. Scientific exploring party in the foreground. The glacier has apparently cut its way through the volcanic rock on which it originally rested. The rate of movement is about 23½ inches a day at the lower portion.



Photos. by A. Curtis.

Typical Crevasses in a Glacier of the Selkirks (British Columbia).

HOW GLACIERS ARE STUDIED.—[See page 534.]

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NEW YORK, SATURDAY, JUNE 30, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A LOCK CANAL FOR PANAMA.

Thanks to the arguments which have been advanced by the President, the Secretary of War, and the Chief Engineer of the Panama Canal, the Senate has voted for a lock canal across the Isthmus—a legislative decision which will probably be welcomed by the engineers who have been intrusted with the building of the waterway and by all Americans who have at heart a speedy termination of an undertaking that means much to the economic advancement of the country. The sharp conflict which has been waged by the advocates of sea-level and lock canals, and which has resulted in a delay both irksome and perplexing to the engineers at Panama, is now happily ended, and that project has been selected which, in the opinion of those most competent to judge, will most satisfactorily fill the immediate need of an Isthmian waterway.

Of the thirteen members of the International Board of Consulting Engineers, eight reported in favor of a sea-level canal and five in favor of a lock canal. Of the six members of the Canal Commission, five were in favor of a lock and only one in favor of a sea-level waterway. Now that the dispute has been settled, the recommendations of the President and Chief Engineer Stevens will no doubt be carried out. According to these recommendations, a gigantic dam is to be erected at Gatun, measuring 7,700 feet in length and 131 feet in height, which dam is to be composed of no less than 21,200,000 cubic yards of material, and upon which the permanence of the canal rests. To this dam a 500-foot channel will lead from the Atlantic. Three locks arranged in a double flight will lift ships from the sea level to the huge sheet of water impounded by the dam at an altitude of 85 feet. Through this great artificial lake, and through the waters that will spread from it back through the Chagres Valley, vessels may steam unrestrictedly at a speed which they could never possibly attain in the sea-level canal contemplated originally. After passing through the Culebra cut to Pedro Miguel, the vessels will begin their descent by means of a lock having a 30-foot lift, and will then steam through another lake formed by a dam erected in the valley of the Rio Grande. A double flight of two locks will drop the ships to Panama Bay. According to the President's recommendations, the canal will have a minimum depth of 45 feet, will be finished in nine years, and will cost $140,000,000.

We have already had occasion to comment on the economy and quickness of construction with which a waterway built on the high-level principle can be built. Chief among the advantages to be enumerated is the substitution for a forty-mile channel varying in width from 150 to 200 feet of two great artificial lakes yielding over thirty miles of deep water through which ships can steam at full speed, free from any risk of grounding or collision. More doubtful, however, is the expediency of building an earth dam at Gatun having the afore-mentioned length of 7,700 feet—doubtful because of the dam's ability to prevent seepage at the base. Still, it must be admitted that the success of the earth barriers at Wachusett in Massachusetts and San Leandro in California justifies the construction which the President and his advisory engineers have advocated.

To the engineer it must be gratifying that his professional opinion has triumphed over the sentimental clamor for a sea-level canal that could be completed only at enormous cost and a chafing delay.

REDWOOD IN THE SAN FRANCISCO FIRE.

In our issue of May 12, 1906, our San Francisco correspondent, in presenting his views of the great earthquake, condemned the use of redwood as a building material, and gave it as his opinion that it seemed fully as objectionable as pine in the "fierceness of its flame, quickness to ignite, and the intense heat of its combustion." He based his condemnation on his personal memory of the Chicago fire, where he had had ample opportunity of observing the inflammability of pine.

A member of the Redwood Association takes us to task for our correspondent's criticism, and furnishes us with letters that he has received from San Francisco officials, all of whom unhesitatingly declare that redwood is more refractory than pine, and some of whom even venture the opinion that the fire was stayed by buildings finished with redwood exteriors.

We are only too well aware of the merits of California redwood to decry its use in unmeasured terms, and too keenly alive to its admirable fire-resisting qualities to class it with pine for ordinary purposes. Still, we may be permitted to believe that any wood, subjected to a heat so fierce that the steel columns of a modern fireproof building sink and bend under it as if made of wax, must be regarded as unsafe, whatever its refractory qualities may be in comparison with other woods, and in that opinion no doubt every builder will concur. For all the safety which it gave, the redwood which was consumed in the great conflagration might just as well have been supplanted by pine or by material even more combustible.

Admitting the ability of redwood to withstand ordinary heat for a greater period than most woods (and this, we take it, is all that redwood advocates claim for it as a fire-resisting material) we must attribute the salvation of that portion of San Francisco which escaped to the very liberal use of dynamite. The fire was stayed in the very midst of redwood structures, it is true, but doubtless its course would have ended where it did, had these same structures been built of other material.

COMPARISON OF WESTERN IRRIGATION RESERVOIRS AND THE NEW CROTON DAM.

One of the most surprising features connected with the work of the Reclamation Service, as well as the one affording highest gratification, is the cost of structures compared with those which have become familiar to engineers in the East.

When the reclamation work was inaugurated, it was a matter of conjecture whether or not the standards of cost for dams, canals, etc., that had been established by engineering practice in the eastern part of the country, could be relied upon as a basis of estimates of the cost of the proposed western structures. As the work has progressed, it has become more and more evident that many classes of engineering work in the West can be performed much more cheaply than in the East, and at the same time the natural conditions are such that these structures are more economical and effective.

If we take, for example, the three great masonry dams now being erected for the purpose of storing water, viz., the Roosevelt dam in Arizona, the Pathfinder dam in southeastern Wyoming, and the Shoshone dam in northwestern Wyoming, we shall find that the effective storage capacity and costs are far below those of some of the great eastern dams like the new Croton in New York and the Wachusett in Massachusetts. The heights of these dams are as follows: Roosevelt, 280 feet; Pathfinder, 210 feet; Shoshone, 308 feet; new Croton, 297 feet; and Wachusett, 207 feet. These heights are measured from the foundation stones to parapet in each case, and they show that the Shoshone is the highest, while the new Croton is second and the Roosevelt third. If, however, the height above the river bed be considered, that is, the effective storage height, the new Croton is the lowest. The order is then as follows: Shoshone, 240 feet; Roosevelt, 230 feet; Pathfinder, 200 feet; Wachusett, 185 feet; and the new Croton, 157 feet. In other words, about fifty per cent of the masonry in the new Croton dam is below ground and is serviceable for foundation purposes only.

It is interesting to note the comparative reservoir capacities. While the new Croton dam is the largest in the world from the standpoint of its amount of masonry, the storage capacity of the reservoir formed by it is by far the lowest of any of those above mentioned. In fact, from a standpoint of storage economy, the new Croton reservoir is one of the poorest that has been constructed in recent years. The dam contains 833,000 cubic yards of masonry, and was erected at a cost of $7,600,000. The capacity of the reservoir formed by it is 4,000,000,000 cubic feet, or a cost of $1,900 per million cubic feet storage. Similar figures for the Wachusett dam show that it contains 280,000 cubic yards of masonry, and was erected at a cost of about $2,000,000. Its storage capacity is 8,400,000,000 cubic feet, or a cost of $238 per million cubic feet storage. In contrast to these excessive costs, the three western dams appear remarkable. The Roosevelt dam, for example, contains 350,000 cubic yards of masonry, erected at a cost of $3,850,000. The capacity of the reservoir is 61,000,000,000 cubic feet, or fifteen times that of the new Croton, and about seven and one-half times that of the Wachusett. The cost of this dam per million cubic feet storage is only $63.16. Even more remarkable appears the Pathfinder dam. It contains 53,000 cubic yards of masonry, erected at a cost of $1,000,000. The capacity of the reservoir is 43,560,000,000 cubic feet, or more than ten times that of the Croton. The cost of the dam per million cubic feet storage is therefore only $22.95, as against $1,900 for the new Croton, and $238 for the Wachusett. Similar figures for the Shoshone dam, the highest in the world, are: Cubic yards of masonry, 69,000; cost, $1,000,000; capacity of reservoir, 20,000,000,000 cubic feet; or a cost per million cubic feet storage of $50.35.

These extremely low costs have seldom been equaled in the history of reservoir construction, and are due largely to the excellent natural facilities which are found in the rugged western country. From this fact it must not be inferred that these western structures are simple engineering works. On the contrary, owing to their isolated location, their inaccessibility by rail and often by wagon, and the erratic and torrential character of the streams, they involve problems which tax the skill and ingenuity of their builders to the utmost.

It is most fortunate that these reservoirs provide enormous storage at relatively low cost. Otherwise their construction would not be feasible, as the irrigated land could not bear the expense of the costly structures of the East with their limited storage capacity.

The Croton dam, if it had been constructed in Salt River Valley in Arizona for irrigation, would only supply 23,000 acres, and irrigators would have to pay $330 an acre for stored water, as against $20, the estimated cost from the Roosevelt dam.

SEEDS AND SUSPENDED ANIMATION.

It has often been observed that any sudden change in the superficial character of the soil is rapidly followed by an alteration in the nature of the plants growing thereon, new species appearing where the ground has hitherto been a stranger to them. Very many farmers, foresters, and scientific men—among others the French botanist Poisson—are inclined to attribute this phenomenon to the retention of seeds, bulbs, or spores of a former growth of vegetation in a quiescent state, these seeds and growths retaining their powers of germination even after several other successive crops of plants have grown above them. Most botanists, however, have doubted the possibility of seeds' retaining their germinating properties for so long a time, and have explained the sudden appearance of strange plants in different places by natural means of seed transmission, as, for instance, by birds, bees, currents of air, and the like. A remarkable fact was once observed by Th. v. Heldreich at the mountain called Laurion in Attica. After the removal of about ten feet of soil and rubble which had been undisturbed for ages, there suddenly sprang up a plant unknown theretofore in that region, viz., a glaucium or horned poppy, accompanied by a rich growth of the fly-catcher or *Silene juvenalis* Del, a plant quite a stranger to Attica.

This mystery of plant life has, so far, been a vexed problem, and several theories have been suggested for its solution. A French scientist (M. Fliche) has recently made some exhaustive studies in this connection, and has observed some interesting phenomena which have occurred with specimens of a southern European plant called wolf's-milk or cypress-spurge (*Euphorbia lathyris* L.). This plant is not indigenous in France; a few years ago, however, some Nancy botanists were astonished to find large quantities of this plant in full blossom in a district where it had never before been seen, namely, in a two-year-old clearing in the large forest of Hane in the canton of Petite Malpierre. Two years later the plants had entirely disappeared. Thick growths were found, however, a short distance off in another two-year-old clearing, but only a few specimens were encountered in another clearing which was a little over three years old. Fliche does not doubt but the gradual disappearance of the plants is due to the influence of steady forest growth, and not to any inferior seed or peculiar germinating powers thereof. In order to determine this point he made several special clearings on the spot, and the result of his experiments was fully to confirm his theory. As the part of the forest where the plants grew was very remote, and seldom visited by human beings, there was no question of the seeds having been carried there either intentionally or accidentally.

At this spot, over forty years ago, the remains of large Gallo-Roman iron works were found. Now Plinius states that the Romans used the *Euphorbia lathyris* for medical purposes; Fliche is consequently convinced that the plants were originally introduced by the persons living at the works, that the seeds lay hidden in the ground when the forest invaded the territory in the course of its growth, and that they did not awaken from their long slumber and again seek the surface till the axe of the modern woodman cleared the ground and paved the way for their resurrection. This opens up quite a new field for the student of Nature's mysteries, and doubtless, as time progresses, some close observer will discover more precise data with which to supplement these brief particulars.

THE HEAVENS IN JULY.

BY HENRY NORRIS RUSSELL, PH.D.

The progress of discovery often forces us to modify our scientific definitions. For example, a few years ago the asteroids were defined as "a group of small planets circulating in the space between Mars and Jupiter." In 1898 a planet was found—the famous Eros—which comes much nearer the sun than Mars does, and there followed some discussion whether it should be called an asteroid or not. Now the limit has been extended in the opposite direction, for a faint object was discovered early last spring, which turns out to be a minor planet which is more remote from the sun than Jupiter is. This object has not yet been named, but is known as T G, according to the system of lettering newly-discovered planets which has been in force for a dozen years or so. The next discovery would be called T H, and so on—and it may give a good idea how fast asteroids are being found, to say that in the last three months enough have been recorded to give the last one the letters U K.

The planet has now been under observation for more than two months, and its orbit is fairly well determined. Its period appears to be a few days more than twelve years—more than half as long again as that of any previously-known asteroid, and two months longer than that of Jupiter. Its mean distance from the sun is 487 million miles, but as its orbit is decidedly eccentric, the actual distance may vary all the way from 405 to 569 millions. If its orbit lay in the same plane with that of Jupiter, it would run a risk of colliding with its gigantic neighbor (whose average distance from the sun is 483 million miles). But the orbit is inclined in such a way that when the asteroid is at the same distance from the sun as Jupiter is, it is high above or below him, while when the two are in line with the sun, it is either much nearer the sun than Jupiter or a good way outside him. However they may be placed in their orbits, they can never come within about fifty million miles of one another.

At the present time they are four or five hundred million miles apart, and will remain so for a long period. The asteroid is ahead of Jupiter, which is gradually catching up with it, but their rates of motion are so nearly equal that in a whole revolution about the sun Jupiter only gains about one-seventy-fifth of a revolution upon the asteroid. As the latter is now about one-sixth of a revolution ahead, it will take Jupiter more than twelve of his revolutions, or about one hundred and fifty years, to catch it. Similarly, we see that it is some seven or eight hundred years since they were last near together.

With more accurate measurements (of the asteroid, which we shall have in a year or two) it may turn out that the intervals between such approaches are a good deal longer or shorter than the rough numbers given here; but it is certain that this small planet has been revolving in its present orbit for a long time, and will continue to do so for many years. When next it gets close to Jupiter, it will stay near him so long that the shape of its orbit may be very greatly changed, and the astronomers of a century or two hence may find this matter very interesting.

It need hardly be said that the new planet is a very faint object. It is of the fourteenth magnitude, and its real diameter may be estimated at about sixty miles, which makes it rather a large asteroid, so far as actual dimensions go, though it is so far from the sun that it appears to be one of the faintest of the group.

THE HEAVENS.

Our map shows clearly the principal constellations of the evening sky. In the northwest the Great Bear is conspicuous. On the left is the Lion, just ready to set. The Virgin and the Herdsman are the principal groups in the southwest, the latter being very high up. In the south is the fine group of Scorpion, now seen at its best. The star α is interesting for its bright red color, and μ because it is double, separable on a clear night by the unaided eye. The Centaur and the Archer (Sagittarius) are on each side of the Scorpion, and the Serpent and the Bearer are above.

The Eagle, the Swan, and the Lyre are the brightest groups in the eastern sky, and the smaller group of the Dolphin is not hard to find. Cepheus and Cassiopeia are low in the northeast, and the Little Bear and the Dragon are higher, above the Pole, while Hercules and the Northern Crown are right overhead.

THE PLANETS.

Mercury is evening star all this month, and is best visible about the 15th, when he is farthest from the sun, and sets about 8.40 P. M.

Venus is likewise evening star, some distance above Mercury, and sets between 9 and 9.30 P. M. all through the month.

Mars is in conjunction with the sun on the 15th, and is invisible all through July. Jupiter is morning star in Taurus, rising about 3 A. M. in the middle of the month. Saturn is in Aquarius, and rises about 10 P. M. on the same date.

Uranus is now well placed for observation, and may be easily identified, being about 2 deg. north and 1 deg. east of the bright star λ Sagittarii (Archer), which is marked on our map.

Neptune is in conjunction with the sun on the 2d, and is invisible this month.

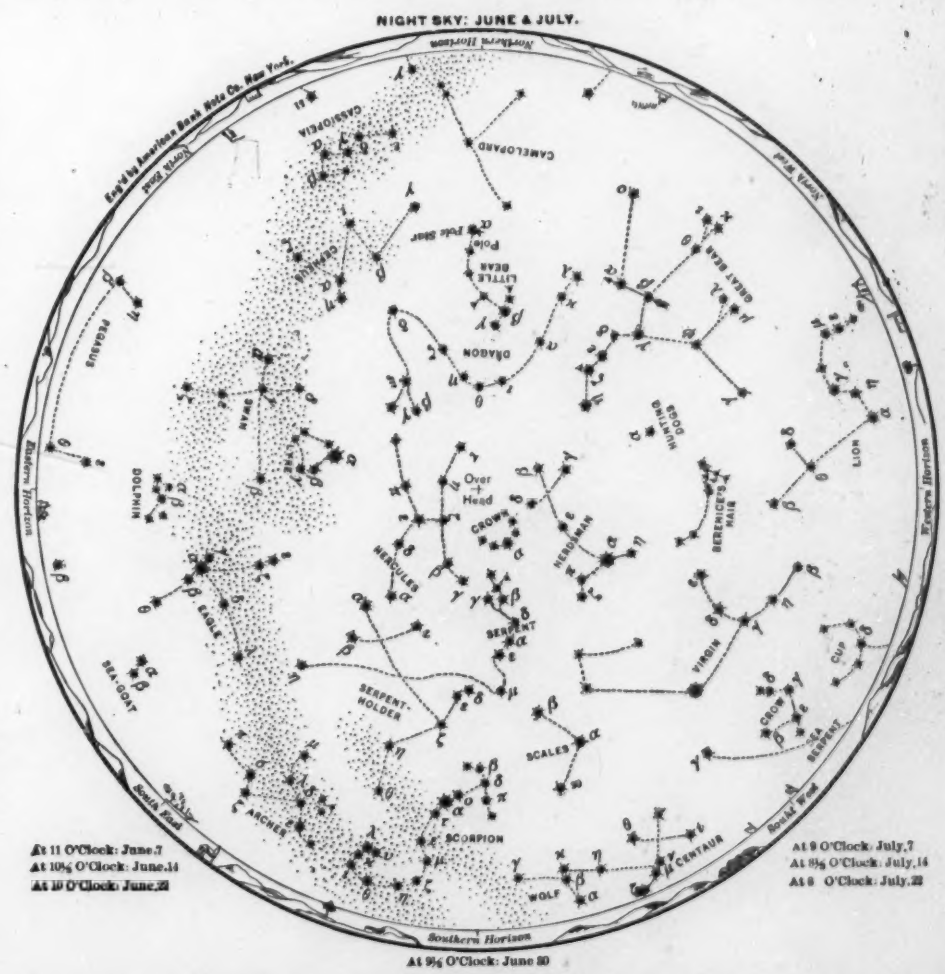
THE MOON.

Full moon occurs at 11 P. M. on the 5th, last quarter at 5 A. M. on the 13th, new moon at 8 A. M. on the 21st, and first quarter at 3 A. M. on the 28th. The moon is nearest us on the 4th, and farthest away on the 16th.

She is in conjunction with Uranus on the 5th, Saturn on the 10th, Jupiter on the 18th, Neptune on the 20th, Mars on the 21st, Mercury on the 23d, and Venus at 2 P. M. on the 24th. The last conjunction is quite close.

On the 21st of July there is a partial eclipse of the sun, but as it is only observable from the Antarctic regions, southeast of Cape Horn, it is of no practical account.

Princeton University Observatory.



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

Palladium has about the same degree of hardness as platinum. It may be easily rolled into sheet, and is usually found in commerce in the shape of thin sheet or foil.

ORIENTATION OF CARRIER PIGEONS.

Dr. G. H. Schneider many years ago conducted some very interesting experiments which were concerned mainly with the education of young carrier pigeons and with the short flights of adults. The results of his work are given in the Zeit. f. Psych. u. Phy. d. Sinnes. The question that Dr. Schneider sets out to answer is this: Are pigeons guided by an inborn sense of direction which is unknown to us, or guided by the eye?

Dr. Schneider transported birds in a basket by carriage or by rail to the desired distance, and released them one by one. The time of the release, the condition of the weather, the number and characteristic markings of the bird, were all carefully recorded. The records were kept of the time of the return. The distances were very short, varying from two miles to twenty-five. Certain experiments were made to determine the relative ease of orientation between releases made in valleys and on mountains.

Schneider's conclusions are numerous, the one of chief interest being as follows: "The assumption that the carrier pigeons possess an inborn sense of direction is an error; for if this assumption were true, then the young pigeons ought to find their way equally well. The investigations have shown, especially those at Könitz, that young pigeons, even at relatively small distances from their home, have the greatest difficulty in finding their way back when the vicinity is at all strange to them, and their home cannot be directly seen." He then concludes that the young birds utilize, in their early flights, the familiar groups of houses, mountains, etc., and that the distances to which a bird may be taken and return may be increased commensurately with the increase in the development of his "topographical memory." The author believes that the pigeon can develop not only "Erinnerungsbilder," but even "Gedächtnisse."

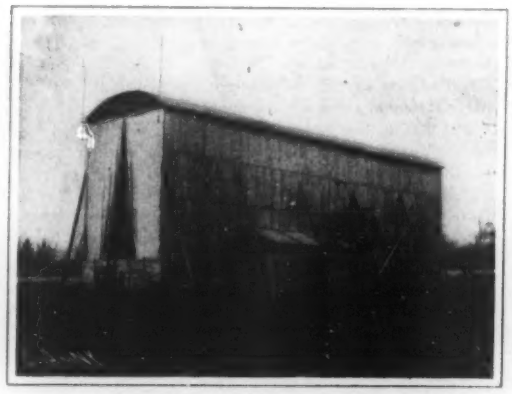
Commenting upon these experiments, a writer in the Psychological Bulletin finds that "Dr. Schneider does not discuss the more difficult feats of the carrier pigeon. He says nothing of their long flights over the ocean. He says nothing of the so-called 'voyaging' pigeons of France. These birds travel over the continent in wagons. A stay of one or two hours in a town enables these pigeons to return to it. He has missed the point in the arguments of those who hold that there are factors in distant orientation which are not explicable by visual sensation or even visual memories. In the first place nobody, we believe, would deny that the pigeon uses vision where he can. And again, it is a mistaken use of the term 'sense of direction' to assume that it does not have to develop. Consequently we should not expect the young birds to return as well as the adult. The term 'sense of direction' is used by careful writers with the implication that there is a definite psychophysical possibility of its being developed—just as there is a definite psychophysical possibility of visual sensations being developed."

Seldom in the history of chemical industry has any chemical product undergone such marked variation of price within a few years as thorium, the principal constituent of incandescent mantles. Early in 1894 thorium nitrate was sold by the German combination at 2,000 marks per kilogramme, and by January of the next year it had fallen to 900 marks; in July of the same year it stood at 500 marks, and in November at 300 marks. In 1896 it fell in May to 150 marks, and in October to 90 marks, touching the low price of 20 marks, in 1899. After that the price was pushed up to 53 marks, less 7 per cent discount, in May, 1904, a figure which the "Convention" succeeded in maintaining till January of this year, when it dropped to 27 marks, less 3 per cent discount.

THE "ITALIA" AIRSHIP.

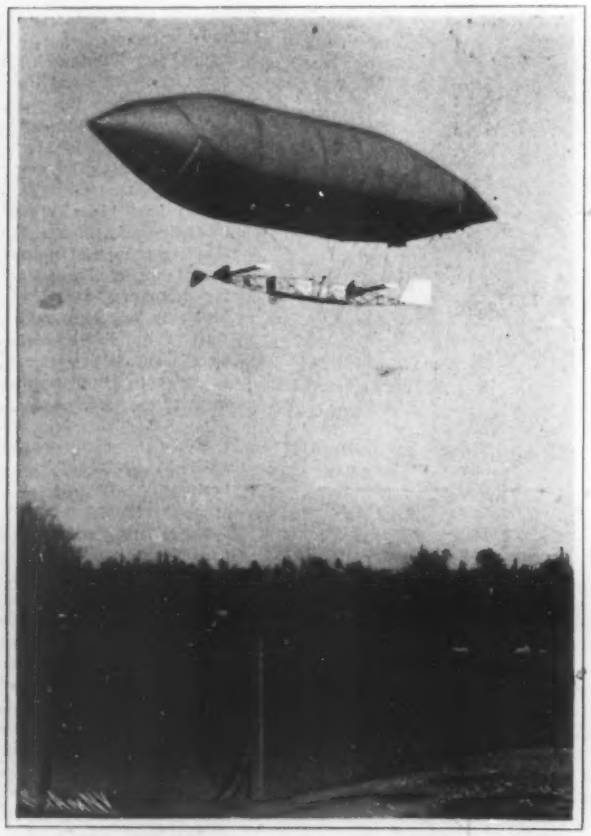
An Italian inventor, Count Almerico da Schio, while convinced of the superiority of the "heavier-than-air" flying machine, considers the airship to be the best means of teaching men the art of navigating the air. The Count thinks it best, therefore, to reject the airship only after man shall have learned to move safely through the air with a balloon to supplement the floating power and stability of the flying machine proper.

The new "Italia" airship is accordingly designed as a complete flying machine including wings, propellers, and rudder, the balloon being made to fulfill the secondary function just referred to, and to become more and more reduced so as eventually to disappear as the flying machine proper is continually improved. The disadvantages common to most balloons of losing ballast in rising and gas in descending, are remedied by using the motor and aeroplanes exclusively for rising and descending. This will allow the airship to remain longer in the air, and will make it able at any time to seek for the most favorable air currents.



The Building in Which the Airship is Housed.

The airship "Italia" constructed by Count da Schio, as can be seen from the photograph, is cylindrical in the middle, throughout a length of 10.3 meters (42.64 feet), the diameter being about 8 meters (26¼ feet). The front part, 11 meters (36.08 feet) in length, resembles the point of a shrapnel, and the much thinner rear part is about 16.4 meters (65.61 feet) in length. The cover consists of varnished Italian silk coated outside with aluminium powder to reduce the effects of light. The regular symmetrical shape of the bottom of the balloon is obtained by coating the lower portion of the cover with highly elastic India rubber such as is used by Prof. Hergesell in connection with his "ballons-sondes." As this part is extremely elastic (it can be stretched to four times its original length) the cover will always be uniformly tightened, and the balloon will maintain its regular shape with a volume varying according to the atmospheric pressure. The horizontal aeroplanes having surfaces of 10 square meters (107.64 square feet) each, used in rising and descending, augment the longitudinal resistance of the airship. The frame is provided with three wheels and pneumatic tires to facilitate its manipulation on land.



The "Italia" Airship in Flight.

Only a few preliminary experiments have so far been made with the Schio airship, in which King Umberto and the Dowager Queen Margherita are taking much interest. While the results so far obtained would seem to bear out the claims made by Count Schio, judgment should be reserved till the definite experiments which are to take place shortly have been made.

THE LAYING OF A 10,000-VOLT CABLE.

BY DR. ALFRED GRADENWITZ.

It is due to the high insulating power of atmospheric air that most electrical phenomena come at all to our notice. The same property of air proves very valuable in electrical engineering by allowing current-carrying conductors to be strung out in the open without the risk of leakage, provided there be no possibility of either a short circuit or a ground. These overhead conductors possess the advantage of being extremely cheap and easily inspected, but they are exposed to various dangers, rendering them unreliable for use in large cities. Here not only the risk of injury to the passer-by, but æsthetic considerations as well, are urged against this type of conductor, and for these reasons cables are usually substituted for bare overhead wires. These cables consist of insulated copper conductors, either single or in sets of two or more; and in order to protect them from injury, and prevent the current they carry from doing any damage, they are buried in trenches.

We are indebted to the Berlin Electricity Works for the accompanying illustrations, showing the recent operation of laying a 10,000-volt cable. The line is intended for transmitting current generated at the Oberspree central power station to the Zossenerstrasse and Alte Jakobstrasse sub-stations. The cable was constructed at the Oberschöneweide Cable Works of the Allgemeine Elektrizitäts-Gesellschaft. It is to carry three-phase current, and accordingly comprises three copper strands of 1.085 square inches cross section each. Each of these conductors, on account of the high pressure carried, is at first surrounded with a caoutchouc layer, and together with the two others is imbedded in jute. Around this insulation a lead sleeve is forced, and this serves to exclude moisture. Over the sleeve is a wrapping of jute, and on this an iron sheathing is wound.

The cable was made in lengths of about 170 meters (557.7 feet) each and coiled on wooden drums. It was carried to the working place in special cars. The trench in which the cable was to be laid was dug to a depth of three feet. After running out the drum from the car, it was taken to the head of the trench, and a gang of workmen seized the end of the cable and carried it on their shoulders into the trench. Here it was dropped into specially arranged rollers, by means of which it was drawn off from the drum. This done, the cable was straightened and provided at intervals with labels indicating its cross section, the voltage it was adapted to carry, etc., so that any required strand might be readily identified in case of future repairs. As the iron sheathing referred to above could not be regarded as a full protection to the high-tension conductors, the cable was coated with a concrete layer. The concrete was placed in rough jute bags, which were tamped down on the cable throughout its length. The jute bags soon gave way, permitting the concrete to set over the upper half of the cable, and thus provide it with a solid concrete covering. The trench was then filled in. The joints

Sections of High-Tension Cable.

Preparing the Protective Sheath.

Laying the Cable in the Trench.

THE LAYING OF A 10,000-VOLT CABLE.

between the cable sections and the mains were protected by iron sleeves locked in place by setscrews, after which the sleeves were filled with an insulating substance. These operations, requiring a great amount of attention and accuracy, were carried on under a tent to guard against moisture and other disturbing factors.

As a perfect insulation of the cable is of vital importance in this work, each of the sections buried in the trenches was immediately submitted to certain tests. The apparatus for this purpose was arranged in a special cable-measuring car, which was conveyed by hand along the cable line, and by means of which the necessary observations were carried on in a minimum of time. To provide for future measurements of the voltage, etc., obtaining at the terminals of the cable, each conductor is provided with a testing wire, the diameter of which is obviously quite small. In one of our illustrations the three testing wires may readily be seen beside the main conductors. At the crossing of the cable line with the Goerlitz Railway, iron pipes receiving the cables were fitted at a depth of three feet below the ties. Seven such cables were laid during last summer, following a common course as far as Vienna bridge, whence they branched off in three strands to the Zossenerstrasse sub-station, and in four strands to the Alte Jakobstrasse sub-station.

MAKING THE FLAGS OF OUR WARSHIPS.

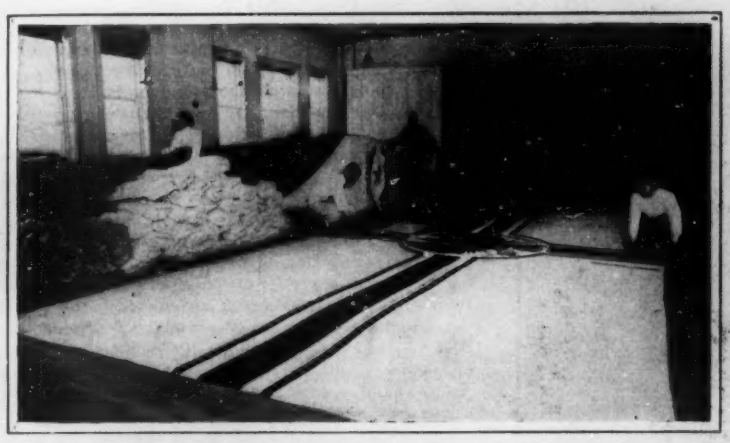
BY WALTER L. BEASLEY.

Through the courtesy of the Commandant of the Brooklyn navy yard and Commander A. Ward, chief equipment officer, the writer was given special opportunities for obtaining a full series of pictures showing an interesting and comparatively little-known department in which the flags of our warships are made. The flag room is under the supervision of Mr. Thomas Malloy, officially rated as master flagmaker, and Miss M. A. Woods, quarter-woman flagmaker. Mr. Malloy favored the writer with all the main details of the flag department, which are outlined in the present narrative.

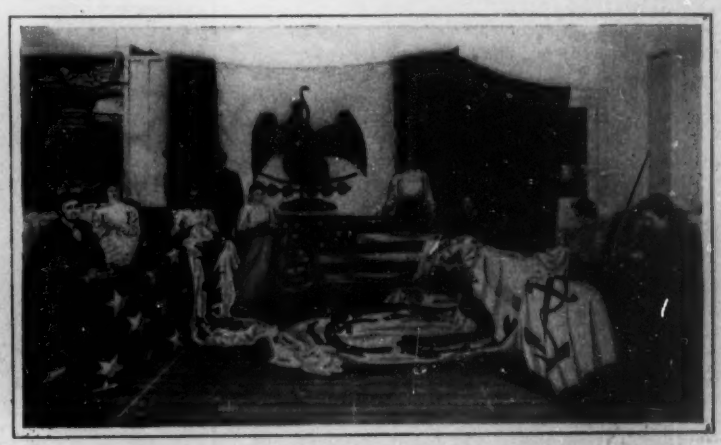
To furnish the many hundreds of naval vessels in commission, ranging from the large flagship and battleships and the numerous smaller class, with their regular quota of flags, the government is required to maintain an extensive plant. Few, however, realize the number of flags carried by a warship, nor the cost of all the gay bunting which flutters from mast to mast at holiday time. In addition to fleet communication, necessary during all forms of maneuvers in home waters, the ship must be equipped with an extensive array of flags stored on board for various forms of ceremonial and official occasions. This "dress suit" outfit of bunting, therefore, consists of 250 different flags, the material and making of which costs Uncle Sam just $2,500. Each ship is entitled to a new flag equipment every three years, though a flagship will often require a new set of signals, owing to their constant use and handling, in about a year.

A striking idea of the number of flags carried by a single ship may be gleaned from one of the accompanying illustrations, showing a pile 15 feet long and nearly waist high, just finished for the new battleship "Connecticut." About one-half of the lot is composed of foreign flags, incased in thick paper bags, with the name of the country stenciled on the bottom. The remainder, including those for ordinary use, signal sets, and the international code, etc., are not wrapped, but merely tied in round bundles. Last year for operating the flag factory the government expended $60,000; $43,000 of this amount was for material alone. This, however, includes a small sum for table linen and curtain fixtures; the labor amounted to $17,000. The number of flags turned out was over 59,000. In all, 408 distinctive kinds were made. To cut out the varied patterns and complete all these miscellaneous flags, some thirty-five skilled machine sewers and needle-women and three men are employed.

With the bright-colored, fantastic flags of all nations dangling from their machines, the long row of flag



Finishing the German Ensign, the Most Expensive One Made.

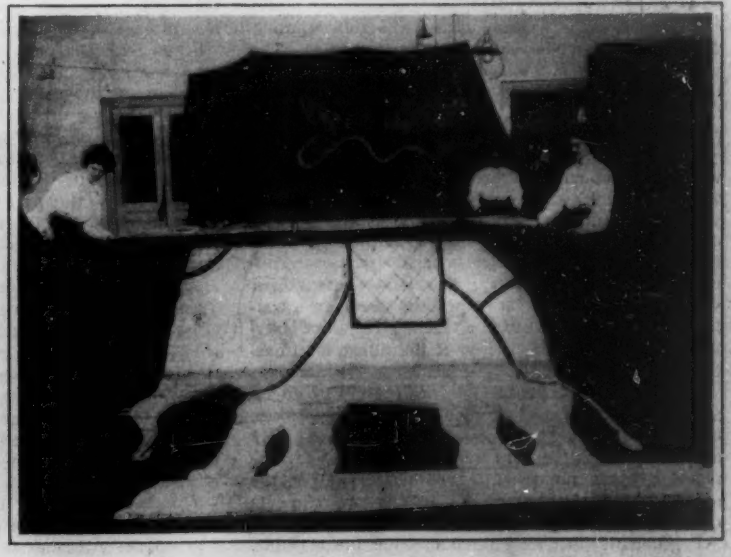


The Hand Sewers Who Execute the More Difficult Designs.

One of the Main Rooms of the United States Flag Factory at the Brooklyn Navy Yard.

The Star Cutting Machine; Sewing On a Halyard Bend.

The Flag outfit for the U. S. S. "Connecticut," 250 Flags Costing $2,500.



Cutting Out Patterns; the Flags of China and Siam Above and Below the Table.

MAKING THE FLAGS OF OUR WARSHIPS.

makers present a picturesque scene. The long spacious room is literally a blaze of color. Rolls of bright bunting are heaped up waiting to be cut, while long lines of women operators are swiftly sewing the seams and putting the finishing touches to American and to forty-three foreign ensigns of different hues and patterns. The flags are cut out from measurements arranged on chalk lines and metal markers on the floor. Large stripes and certain designs can be more conveniently stitched in this way. Daily a section of the floor is covered at all hours with several different flags, with the men and women cutters at work. The final sewing is done on machines by the women. Each machine is run by a small electric motor of one-fourth horse-power. Owing to long service, the labor has become highly specialized, and the women are kept at work on the particular flags which they can make the best. Some excel in sewing on the stars, others in finishing certain other parts of the flag. Nearly all have been in the establishment for years. Their pay averages from $1.20 to $2 per day.

A great deal more time and labor is required to finish certain of these flags than is generally supposed. For instance, the President's flag requires the longest time of any to make, as it takes one woman a whole month to complete it. The flag consists of a blue ground with the coat of arms of the United States in the center. The life-sized eagle, with long outstretched wings, and other emblems, are all hand-sewed and involve the most patient work. The flag is made in two sizes, 10 feet by 14 feet and 3 feet by 5 feet. The silk used on this and other designs costs $9 a pound. The largest flag made is the United States ensign No. 1, 36 feet long by 19 feet wide, which costs $40.

The most difficult, expensive, and likewise consuming the longest time to make, are the foreign flags. This is especially true of the South American and certain others. These in most cases average 5 feet in diameter. The work is done by a half-dozen specially skilled hand device sewers, each having acquired the knack of making certain of the center designs to perfection, and continually kept on these respective flags. Every battleship carries forty-three foreign flags, 25 feet by 13 wide. A smaller size is also made. The weakest in point of power and smallest of the Latin nations have the most gorgeous and picture-bedecked ensigns. That of San Salvador is especially so, and requires much time and patient labor to complete. The half-tone representation of this hardly brings out the wealth of detail and elaborate sewing that is expended on it. For a center piece the San Salvador has a regular marine landscape, consisting of a belching volcano and a rising sun, set in a varied design of draped banners, cactus branches, cornucopias, and a swastika on the ground of a rayed diamond, with the date of the independence of the nation inscribed on the top. One hundred different pieces are used to form the center design. It takes one woman sixteen days to complete the San Salvador ensign, which costs $52.50. The most expensive ensign to make is the German, which, owing to the delicate scroll work of the large imperial eagle and royal crown, necessitating delicate, slow, and careful sewing, costs $56.50. The dragon flag of China consists of two hundred separate pieces. Twelve to fourteen days are ordinarily consumed in finishing this flag, which costs $51.75. The flag of Siam with the huge white elephant costs $38. The Mexican, with its center design of a large eagle holding a serpent in its bill, cost $39.50. The cheapest foreign flag made is the Moorish, which costs $21.

Last year 150,000 yards of bunting were used. This is all wool, 19 inches wide. Samples of English and Italian bunting have been tested in the past to compare with the American. The former lacked in tensile strength and was over-weight, and the red lost considerable color in the washing tests. The Italian filling was not up to standard, and likewise lost color. The warp and filling of the navy bunting now used has thirty-four threads to the inch, and is of light weight—a very desirable feature. The material is given both a chemical and physical test. For the former several strips are cut from a bolt, which are soaked and washed in soap and fresh water for twenty-four hours. The next day the same process is followed, using salt water. They are then exposed to the weather for ten days, thirty hours of which must be in the bright sunlight. This is for the color test. No fading or running of colors is tolerated. For tensile strength, a strip of the warp two inches wide is placed in a testing machine, and must have a tensile strength of sixty-five pounds, while two inches of the filling must sustain a forty-five-pound test.

The many thousands of stars are cut out by an ingenious machine, specially devised for this purpose, operated by a four-horse-power electric motor. Only a few years back the stars were cut out by hand. The machine has a plunger fitted with steel knives, the shape and size of the star. A single down stroke cuts out from fifty to one hundred at a time.

Pressing the foot on a pedal operates the machine. In all, eight different sizes of stars are used, each having a special die. Running the machine for only an hour a day furnishes enough stars to keep the women operators going for several days. The stars vary from fourteen inches in diameter to less than two. All completed flags are pressed by an electric ironer. A heading of flax raven canvas is sewed on, together with a distance lining of plaited hemp rope. This fiber will not kink or twist, and is specially made for flag purposes on board the naval prison ship at Boston. Wooden toggles for catching the loop are also put on, and the border stamped with the name of the flag and date of contract. After being critically inspected and passed by Master Flag-maker Malloy, the flags are delivered to the general storekeeper in the yard, where they are held until needed by commissioned ships.

HOW GLACIERS ARE STUDIED.

BY CHARLES WILES.

Despite the interest that has been taken especially in recent years in the study of glaciology, the thickness of but one of the world's glaciers has been accurately determined. This is one of the ice formations in the Tyrol, which has been pierced by the tedious process of hand drilling, and its depth from the formation on which it rests to the surface of the ice ascertained to be a little over 400 feet. The thickness of the great Piedmont glaciers, such as the Malaspina and Miles, and the Alpine glaciers in the Cascades of the United States and the Selkirks in British Columbia, have only been estimated by those who have made a study of them.

Photo, by A. Curtis.

A Hard Climb.

HOW GLACIERS ARE EXPLORED.

While scientific observation on other lines has been materially aided by funds advanced by institutions and individuals, glacial study in America has not had the support its importance merits, and much of the data we have of the great ice masses lying on the coast and mountain slopes of western America is due to the efforts of a few investigators, who in some instances have taken up the work unaided financially. Thus it happens that the surface dimensions and glacial flow or movement have embraced most of the information with which we are familiar. For example, the Nisqually, one of the largest on Mount Tacoma or Rainier, has been calculated to be at least 500 feet thick near its lower edge. A study of the ice wall at the point where it terminates in the Nisqually Valley would indicate that these figures are not exaggerated, and that the slope of the valley which is covered by the glacier may be more abrupt than is generally supposed. Should this be the case, the thickness at the bottom may be much more than the estimate given.

This lack of data in connection with glaciology is more noticeable for the reason that the glaciers, not only in the Alps but in the western portion of the United States and in British Columbia, have been the subject of careful study. The notable group on Mount Tacoma (Rainier) has formed an attractive series for scientists. As far back as 1857 at least one of the formations on Tacoma was known, but no authentic information was obtained until investigated by Prof. E. S. Emmons in 1870. In 1905 Prof. Le Conte, of the University of California, ascended the mountain, and with his associates devoted considerable time to a careful survey of the Nisqually glacier. The results of the investigation of this party proved of much value in adding to information on the subject, although, as stated, no measurements of the thickness of the ice could be secured except figures based on general estimates. The surface of the Nisqually was measured by the use of such well-known instruments as the theodolite, and its width and length accurately noted for what was probably the first time.

The movement of this glacier has been the subject of much attention among scientists, who have visited Mount Tacoma, on account of its shape and location. Lying in a valley inclosed by walls of lava formation, the glacier apparently has cut its way through the volcanic rock on which it originally rested, for the walls on either side rise above the ice surface to a height ranging between 1,000 and 1,500 feet. The incline of the glacier downward is at a very steep angle for the greater portion of its length. In fact, the head of this great river of ice in places is almost a vertical wall. Consequently, the downward pressure is enormous. In summer, when the lower portion disintegrates more rapidly on account of the rise in temperature, the fissures or crevasses in the surface are much more numerous. The movement of the ice mass in connection with the moraines is of such extent, that one can distinctly hear the sound produced by the cracking and grinding of the ice at a distance of a half mile from the gorge in which it lies. That the Nisqually is one of the most active glaciers in North America is shown by the fact that in a single day the lower portion has moved twenty-two inches. One of the most rapidly-moving glaciers thus far measured is the Mer de Glace in Switzerland, which has a record of thirty-five and one-half inches in twenty-four hours. Needless to say that the movement varies considerably, depending much upon the time of the year, as well as the bed on which the glacier rests. Should the formation change in character by the erosion of the ice, and the latter encounter a soft rock stratum, its downward movement may increase considerably, owing to the decrease in resistance to it. The width of the Nisqually from edge to edge is nearly 1,500 feet; its depth has been estimated at 500 feet. The crushing force of such a mass can only be imagined. Looking down into the abyss in which the glacier lies, the Niagara gorge seems of insignificant proportions in comparison.

The Nisqually is one of four large glaciers which form the upper ice cap of Mount Tacoma—a cap of such dimensions that at a distance of sixty miles the top of the mountain appears to be entirely covered with it. Like the Nisqually, each of the others forms the source of one of the most important rivers of the Northwest, this single mountain giving birth to the Nisqually, the Cowlitz, the Puyallup, and the White rivers. Including the smaller ice fields, Mount Tacoma contains no less than sixteen glaciers. Consequently it affords in itself a broad field for the study of glaciology.

As has already been stated, the surface of glaciers is measured by some of the methods usually employed in civil engineering. To ascertain the movement, however, a somewhat novel plan has been adopted in connection with the Tacoma glacier. Selecting suitable spots on the surface, holes are cut in the ice into which stakes are firmly driven. Care is taken, however, to set the stakes in a straight line at right angles with the length of the glacier. The stakes are placed at nearly equal distances apart, the line extending a considerable distance across the surface. Other stakes or base marks are made on the bank at the side of the glacier. The change in the position of the stakes after they have been driven aids in determining the glacial movement, for they not only show the total extent to which the ice mass has worked its way downward, but the more rapid movement of some portions than others, as the line of stakes is so irregular. For example, the stakes in the center may be considerably in front of those at the side, indicating that here the downward and forward pressure is greatest. Another method of ascertaining the movement is to substitute cairns of stone for the stakes, locating them with special relation to "monuments" on the bank, so that the movement can be gaged by their position after being erected.

Prof. Le Conte's party had a special opportunity to observe the extent of the crevasses in the Nisqually as well as the Cowlitz glaciers, since their investigations extended beyond the *névés* in each case. The trip up the mountain was made from Reese's camp in the Paradise Valley, which is bounded on one side by the Nisqually gorge. One of the principal routes taken in reaching the summit is up the head of this valley, skirting the precipices known as Me-

Clure's rock and Gibraltar rock, the latter extending nearly to the head of the Nisqually glacier. The accompanying photographs give an idea of the ice climbs and snow crossings which the party encountered during its investigation.

While none of the larger crevasses could be precisely measured as to depth, it was the conclusion of the observers that few if any of those on Mount Tacoma exceed 150 feet in depth, although guides on the mountain claim to have come across fissures in the Cowlitz formation over a half mile in length. It is believed that the depth of these ice cracks in the Alps as well as in America is often grossly exaggerated, and that instead of being 300 or 500 feet as is sometimes stated, they seldom exceed 200, since the downward movement of the ice continually tends to force the walls of the crevasse together, overcoming the force which originally caused the disruption.

The Industrial Uses and Value of Alcohol.

BY HENRY HALE.

(*Continued from page 511.*)

The automobile in this country is but one way in which the internal combustion engine is finding favor as a substitute for steam, for animal power, and for human labor. A conservative estimate of the number of such motors in service in the United States at the beginning of the present year placed it at 300,000, including mechanism for operating small vessels as well as stationary engines. The rapidly expanding use of this form of power is shown by the present output of companies making a specialty of constructing so-called gas and gasoline engines. One plant located in Philadelphia is building about 1,200 engines this year, which will aggregate 20,000 horse-power. This is a branch of a German corporation which constructs liquid fuel motors ranging as high as 3,000 horse-power for an individual installation. The American orders of this company during 1906 will need a supply of at least 6,000,000 gallons of fuel for their operation. The Board of Commerce of Detroit, which is a notable manufacturing center for small motors, has made a canvass of the various companies, and has learned that during the present year they will complete mechanism for automobiles, marine use, and for pumping which will require at least 200,000 gallons of fuel daily when in operation. As a further indication of the expansion in the motor industry, two plants in Chicago have increased their facilities until they now have a combined capacity for building no less than 50,000 motors annually, ranging from 1 to 20 horse-power each.

As yet gasoline constitutes the staple fuel for the internal combustion engine in the United States. Therefore its properties compared with those of ethyl alcohol as a source of power are of no little interest. Fortunately, alcohol has already been employed for internal combustion motors to such an extent that its advantages or disadvantages can be correctly determined. In Germany a series of very exhaustive shop tests have recently been made with gasoline and alcohol with engines which varied in size from 10 to 30 horse-power. The results obtained showed that an engine of a given size—that is, a given cylinder capacity—produced an average of 20 per cent more power when run on alcohol than when operated with gasoline. This is due to the fact that it is possible to get a higher efficiency from alcohol, because it can be compressed to a much higher degree without danger of spontaneous combustion than is possible with gasoline. The thermal efficiency of the engine, that is, the degree of utilization of the heating value of the alcohol, is therefore much greater than it is with gasoline, the figures being about 21 per cent for gasoline as against 30 per cent or more for alcohol. The consumption of alcohol per horse-power at this test was practically the same in volume as when using gasoline—about one-eighth of one United States gallon per hour. This is as far as the shop tests made with such engines before shipment were carried.

Another test has been made by a chemist, a professor in a German university, the object being to determine the effect of the exhaust gases upon the interior portions of the engine and its connections, and the degree to which the atmospheric air would be contaminated if the exhaust gases, as might be the case, were puffed out into a room occupied by human beings. This was done with a view to using alcohol locomotives for transporting cars in mines instead of using horses, mules, or gasoline power. The results showed that these exhaust gases contained 20 per cent less obnoxious constituents than the exhaust gases from a gasoline engine. It was also shown that an alcohol engine produced about 30 per cent less constituents which tend to contaminate the air than a number of horses doing the same amount of work as the engine. In addition to this, the horses or mules will keep on fouling the air when they are doing no work at all, which, of course, is not the case with an alcohol engine when idle.

Tests have also been made of engines in actual service in this country by employing the two fuels under the same service conditions, the motors being of 10 and 15 horse-power. A few preliminary tests were made to compare the rate of evaporation and danger of explosion of gasoline and alcohol. First, a surface about six inches square was covered with equal volumes of gasoline and alcohol. The alcohol took twice as long to evaporate. Second, a small quantity of gasoline in a receiver placed in any part of an iron bucket had, at the end of a half hour, filled the bucket with explosive mixture, so that a lighted match placed anywhere in the bucket caused an explosion. The same experiment tried with alcohol failed entirely, although the alcohol was allowed to stand a longer time. There are two reasons for this. Even dilute mixtures of gasoline vapor and air are explosive, and gasoline vapor, being much heavier than air, diffuses upward very slowly, thus keeping the mixture near the liquid rich enough to be explosive.

The 10-horse-power engine was tested with alcohol in the same condition in which it had previously run on gasoline, without any change whatever. It developed 11 brake horse-power, as against 10 horse-power with gasoline, and consumed 1½ pints of alcohol per horse-power per hour. By increasing the compression of the engine, this consumption was reduced to 1.1 pints per horse-power per hour. There was no difficulty in starting the engine on alcohol, even when cold. This is particularly important to determine, as in the German engines it was necessary to start the engine on gasoline and turn on the alcohol after the engine had "warmed up," which took about two or three minutes. The 15-horse-power engine showed similar results, the power developed being 16.5 as against 15.2 with gasoline, while the spirit fuel consumption was 1.08 pints per brake horse-power per hour.

In this connection it may be added that alcohol has been substituted successfully for gasoline in a trial made with the engines of a United States submarine torpedo boat. A test of several hours' duration was made, during which an engine was connected to two full tanks, one containing gasoline and the other alcohol, in such a manner that either of the two fuels could be turned on or shut off. The engine was first started on gasoline, and after a half hour's run the gasoline was shut off and the alcohol turned on. There was no change then in the amount of power developed, but the fuel supply valve had to be opened a little more, increasing the consumption from 0.110 of a gallon to 0.130 of a gallon per horse power hour. The engine was shut down after a two-hour run, allowed to cool off, and was started on alcohol and run for another period of one hour. It was then taken apart, and the cylinder valves and interior portions of the engine were carefully examined by the engineer. It was shown that the parts exposed to the combustion were as free from rust or sediment as they generally are when using gasoline.

Referring again to Germany, in 1905 over one thousand engines were built in that country to utilize denaturized alcohol exclusively. They included motors for vehicles and boats, motors to drive farm machinery, motors for pumping water as well as for electric light plants, bakeries, and flour mills. All these are actuated on the same principle as the gas or gasoline engines. The alcohol is injected into the cylinder in the form of spray, being compressed by the piston on the return stroke. The contact points of the electric igniter extending to the interior of the cylinder to provide the spark which explodes the vapor.

The value of the alcohol motor in modern agriculture, especially on the extensive farms of the West, promises to be of great importance. With an abundant supply of raw material at hand, plants for distilling spirit can be erected wherever liquid fuel is needed, just as the grist mill supplied the neighborhood with flour in the old days. It is not necessary to transport it long distances by rail or water at so much extra expense for transportation, consequently the farm motor should become as much of a necessity as the plow and the harvester. The small stationary motor of one or two horse-power is sufficient to grind the feed, saw the wood, churn the butter, actuate the cream separator, and run the mill. The next improvement to the traction engine will doubtless be the substitution of internal combustion for steam, which means that all of the more arduous farm labor, such as plowing, harrowing, cultivating, harvesting, threshing, shocking corn, etc., can be accomplished even on small farms more rapidly and economically than by the employment of horse power.

One of the principal obstacles to the reclamation of the arid territory of the West has been the expense of operating machinery for pumping water where reservoirs could not be located to furnish an adequate supply by gravity. Many irrigation sites are at such a distance from petroleum wells, coal deposits, and woodland, that the cost of fuel for the pumping engines is prohibitive. As the sugar beet forms one of the staple crops of irrigated land, and, as already stated, yields a large percentage of alcohol, it is only necessary to raise a sufficient crop of these vegetables to insure a permanent supply of power for pumping and all other machinery required.

Correspondence.

Immunity of Mines from Earthquakes.

To the Editor of the SCIENTIFIC AMERICAN:

In corroboration of the statement of your correspondent, E. D. Guilbert, of San José, regarding the fact that earthquakes were not felt down in the mines at Honduras, I will state that the same phenomenon was experienced at the New Almaden quicksilver mines, near San José, where the workmen, 1,500 feet under ground, did not feel the shock, though buildings at the mouth of the mine were shaken down by it. Can you or any seismic expert explain this singular phenomenon? Furthermore, will you kindly publish the fact that this beautiful "city by the sea" has not been "wiped off the map" by a tidal wave at the time of the earthquake, as has been falsely stated by many eastern papers? There was no tidal wave, and very little damage was done by the earthquake, aside from chimneys being broken. Not one person in the city received any injury from it. CHARLES WITNEY.

Santa Cruz, Cal., June 13, 1906.

Earthquake-Proof Cemetery Monuments.

To the Editor of the SCIENTIFIC AMERICAN:

In enlarging her cemeteries, San Francisco might do well to adopt a custom I noticed in the South just before the earthquake, and whatever might befall her residences, her memorials of the dead could not be shaken down. In Rosehill, the cemetery of Macon, Georgia, a very beautiful and thriving city of 40,000 inhabitants, most of the tablets lie flat on the ground. A large proportion of them are plain brick and mortar slabs, of various sizes, those for adults being about 3 feet by 6, certainly not a durable or attractive style of architecture. Often a lot would contain a large number of these slabs, with a few of marble, and many of the later and more ornate of polished granite.

The stone slabs usually bear brief inscriptions, the brick rarely, though sometimes ornamented with vases and sea-shells. Among them are scattered monuments which, of course, are upright, and bear the usual inscriptions of loving remembrance. The later memorials are heavier slabs with more ornamentation, and most of them lie on the turf or are raised slightly above it. The general effect as one looks over the slopes is very pleasing, though of course the brick slabs have nothing to recommend them either of beauty or durability.

In my own mind I reasoned that the custom must have originated in war time, when labor and material were both wanting; but I was informed by Mr. Massonburg, the city clerk, that it bears date much earlier. He came from the Jamestown peninsula, in Virginia, sixty years ago, and noticed the same thing near there, and thinks it was brought from the old country by the earlier settlers of the colony. G. S. PAINE.

Winslow, Me., May 20, 1906.

The Panama Canal Problem.

To the Editor of the SCIENTIFIC AMERICAN:

Will you please inform me if it has ever been proposed to build a 30-foot earth dam at Gatun (for the Panama canal), maintaining this level to the foot of the northern slope of Culebra, with a 60-foot level through the cut, maintained by a masonry dam and single lock supplied with water from Gamboa basin through a side channel? It would necessitate a minimum level of 60 feet in the basin, with a reserve capacity above this level for the reception of the Chagres floods, controlled at the side channel by suitable flood gates.

On the Pacific slope dams with single locks would be necessary at Pedro Miguel and La Boca. The dam near Obispo would be comparatively inexpensive, as the artificial channel only would be encountered, probably with bedrock foundations at its bottom.

Locks in flight would be altogether avoided by this plan, and the Gamboa dam would serve the doubly valuable purpose mentioned, which with the creation of a great water power at this point would justify its erection.

If the maintenance of an 85-foot water level by an earth dam at Gatun is a feasible work in the opinion of some engineers, but contested by others, there would certainly be little room for differences of opinion concerning a 30-foot level dam. The efficiency of a canal of this type would doubtless be fully equal to that of sea-level construction, while the saving at Culebra and throughout the whole course of the canal would be enormous. The free sailing advantages of the 85-foot level type would also be secured, and a considerable item in land damages avoided. W. F. CLEVELAND.

Chicago, Ill., June 6, 1906.

[Among the many earlier studies of the Panama canal problem there was, we believe, a proposal to build a dam of moderate height at Gatun and a dam for a 60-foot summit level at Bohio. This plan is being suggested as an alternative to the 85-foot Gatun dam.—ED.]

OIL FUEL ON SOUTHWESTERN RAILROADS.

BY DAY ALLEN WILLEY.

The series of illustrations recently given in the SCIENTIFIC AMERICAN showing the enormous production and consumption of petroleum, present an idea of its great value, especially for fuel. Perhaps no interests have been more benefited in this country by the abundance of fuel oil than those of the railroad companies especially in the West and Southwest. The substitution of liquid fuel for coal and wood on the Pacific coast is so extensive that nearly all of the freight and passenger locomotives of the principal systems, such as the Santa Fé and the Southern Pacific, burn petroleum exclusively. While many of the standard coal-burning engines have been equipped with oil-burning apparatus, and the space devoted to coal utilized for oil tanks, a large number of locomotives has been designed and built exclusively for the use of liquid fuel. The comparative tests that have been made of the best steam coal and of ordinary petroleum such as is produced from the California and Texas region prove beyond question that the latter is far more economical. Its use has passed well beyond the experimental stage.

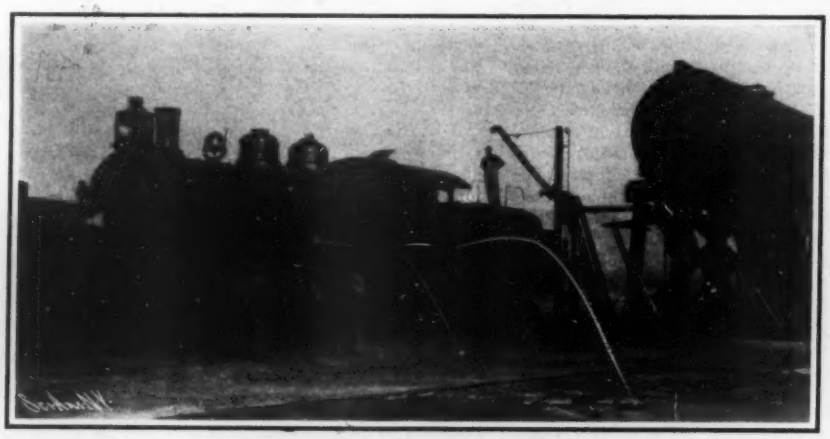
One of the great advantages of petroleum is that fueling stations along the various systems can be supplied with it at a minimum cost and with little inconvenience, the oil being stored in reservoirs which are filled from trains of tank cars. The storage reservoirs are usually located adjacent to the water tanks, and the conduits serving the locomotives may be placed next to the water pipes, so that fuel and water tanks of an engine can be filled at the same time. In fueling a locomotive, a pipe similar to the ordinary pipe used for filling the water tank is employed, the upper end swinging on a flexible joint at right angles to the vertical pipe, which is connected to the supply reservoir either by an elevated or surface conduit. The connection is such that upon the opening of a valve the oil will flow into the engine tank by gravity. The accompanying illustrations show the method employed on the Santa Fé and the Southern Pacific systems.

The cost of equipping a passenger or freight locomotive with oil-burning apparatus ranges between $100 and $150 to each engine, some of the systems being more expensive on account of the patents. The experience of the engineers with the liquid fuel is that they can make steam in about one-half the time required to get a coal-burning engine ready for service. By means of the ordinary burner the supply of oil can be regulated to a nicety, the flame being watched through a peep-hole in the furnace door. By noting the hue of the flame the fireman can tell at a glance whether the spray in which the fuel is forced into the fire-box contains too much or too little petroleum, and the proportion can be increased or diminished by merely turning a regulating valve. If the flame is white the combustion is practically complete. Engineers who have been utilizing petroleum claim that it becomes a smokeless fuel if the firing is properly done. This alone gives it a great advantage over coal, to say nothing of the reduced labor of the fireman.

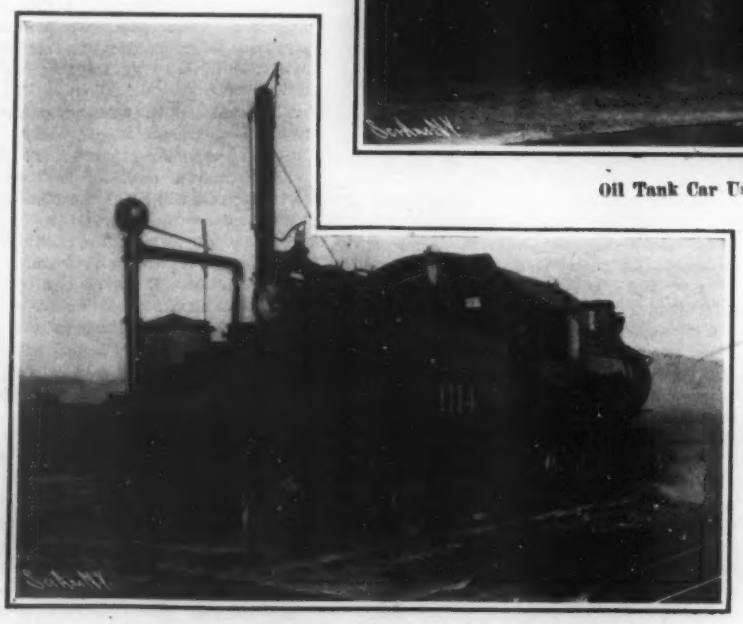
The main difficulty experienced in the burning of liquid fuel is the formation of a deposit in the bottom of the firebox when the combustion is not perfect. This forms a mass so hard that it is necessary to break it up with an iron bar in order to remove it. When a layer of the carbon has formed it decreases the draft and makes it difficult to keep up the requisite steam pressure. Another difficulty which has been encountered is the tendency of the oil to clog the spraying conduits. Being secured from a wide area of territory the oil is not of uniform consistency, some kinds having higher specific gravity than others. If too much of the heavy oil is forced through the spraying apparatus, it may choke the feeding conduits, so that the feed ceases and the steam cannot be generated. A few instances have occurred on the southwestern lines where engines have been disabled from this cause, but they are only occasional.

The use of petroleum fuel is of especial value in southeastern California and in Arizona, where the distance from the nearest coal deposits is so great that the expense of transporting coal to the several supply stations is a very important item. As three barrels of oil equal a ton of ordinary steam coal, a train of tank cars will carry a much larger supply of fuel than a coal train of the same tonnage. Going from station to station, enough cars are switched off at each to fill the reservoirs. This operation is usually performed by an ordinary steam pump, as the reservoir is placed on an elevated base so it can be emptied by gravity.

A Turn of the Lever Regulates the Supply. Intensity of Combustion is Indicated by the Color of the Flame.



Oil Tank Car Used as Fuel Station.



Locomotive Filling Oil and Water Tanks Simultaneously.

OIL FUEL ON SOUTHWESTERN RAILROADS.

There are over 7,000 parts in a well-known 24-horse-power motor car.

Temperature of the Sun.

The *savants* who have busied themselves with determining the temperature of the sun have given us very different figures. One of the first, Father Secchi, director of the observatory at Florence, says L'Illustration, by means of utilizing the height of the solar protuberances, attributed to the king of the stars a temperature of 10,800,000 deg. F. Some years ago Violle contented himself with a temperature between 3,632 deg. F. and 5,432 deg. F. His method was simple and ingenious: a thermometer is placed at the center of an opaque, hollow ball, allowing the solar heat to penetrate through a very small aperture. The diameter of the aperture and the heating of the thermometer permit the solution of the problem in a certain measure, by means of calculations based upon the diameter of the sun, its distance from the earth, and the law of radiation through the atmosphere. Other figures were further proposed—2,052 deg. F. to 3,092 deg. F. by Pouillet and Soret, 11,732 deg. F. by Wilson, etc.

The various methods employed, the article goes on to say, were vitiated by fundamental flaws which explain these divergencies. An infinitesimal error of observation results in an enormous number. On the other hand (whatever certain specialists pretend), we know nothing precise of the constitution of the atmosphere, or of what replaces it at a few kilometers above us; nothing, consequently, of the manner in which the calorific radiation acts in the mysterious heights.

M. Moissan, by an indirect process resting upon particularly reliable foundations, has just shed new light upon the solution of the problem. The great chemist (inventor of the electric furnace, thanks to which he has been able to volatilize the metals refractory to the action of the previous furnaces) has proved that there exists upon our planet no substance that cannot be liquefied and distilled by the heat of the voltaic arc, to which is universally given a maximum temperature of 6,000 to 7,000 deg. F.

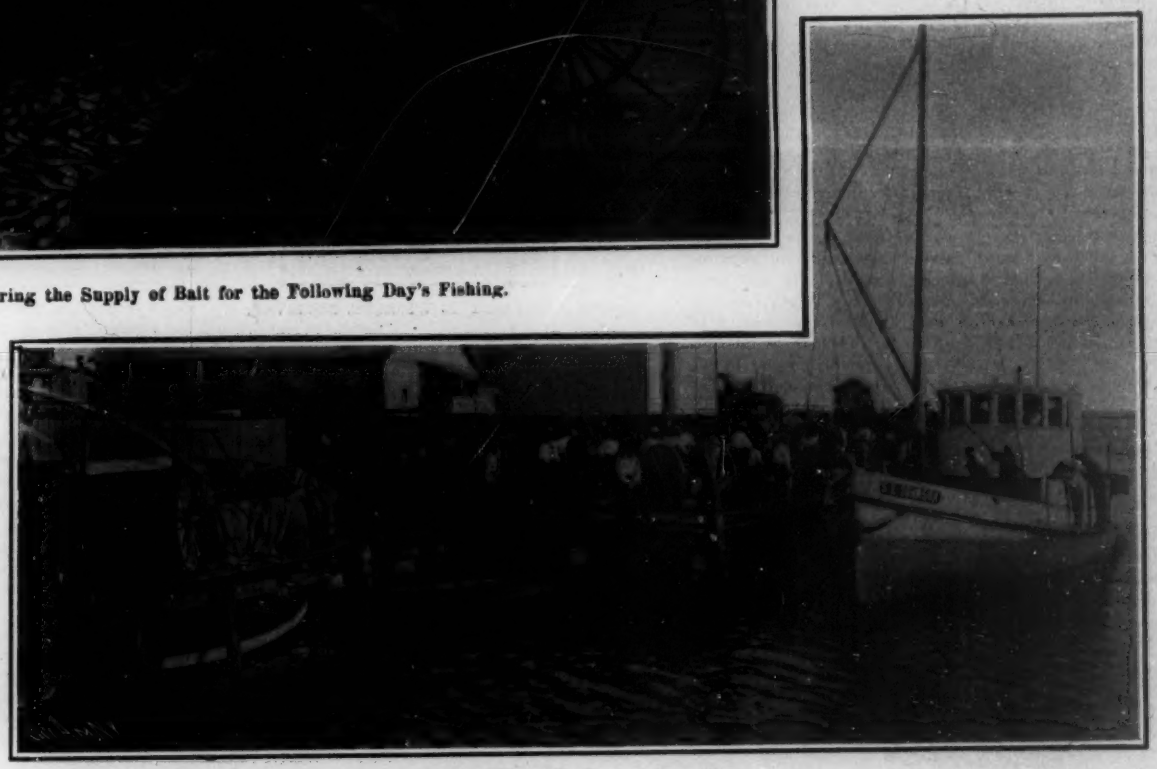
Now, spectroscopic experiments teach us that the majority of the simple substances existing upon the earth are found in the sun. On the other hand, it is probable that, on account of the very quantity of heat that it radiates, the sun cannot be formed merely of gaseous materials that, overheated, could reach temperatures much higher than the temperature of distillation, but must contain a solid or liquid nucleus. Its temperature, therefore, should not exceed that at which the numerous substances common to it with the earth distill. Let us remark, however, that the distillations of M. Moissan were produced at the ordinary temperature. There may exist in the sun a pressure that raises this temperature; which, it seems, should be comprised between the number of Wilson, 11,732 deg., and that of Voille, 5,432 deg., but probably nearer the latter. So we are far from the 10,800,000 deg. of Father Secchi.

Comparison of Cost of Concrete and Stone Masonry.

The cost of concrete and stone masonry varies largely with the local conditions and the character of the work on which they are used; but there are very few places where concrete masonry is not only cheaper than stone masonry, but better, being much stronger and more suitable in many ways. This fact is becoming more generally recognized, and more than one quarry which in former years produced building stone is now producing crushed stone for concrete. The following figures give a general idea of the comparative cost of brick masonry and concrete, per cubic yard:

Brick.	
500 brick	$3.75
⅔ barrel cement	1.50
¼ load sand	.50
Labor	2.25
Making a total	$8.00
Concrete.	
1 barrel Alpha cement	$2.00
¼ load sand	.50
Broken stone	1.50
Labor and forms	1.50
Making a total	$5.50

Procuring the Supply of Bait for the Following Day's Fishing.



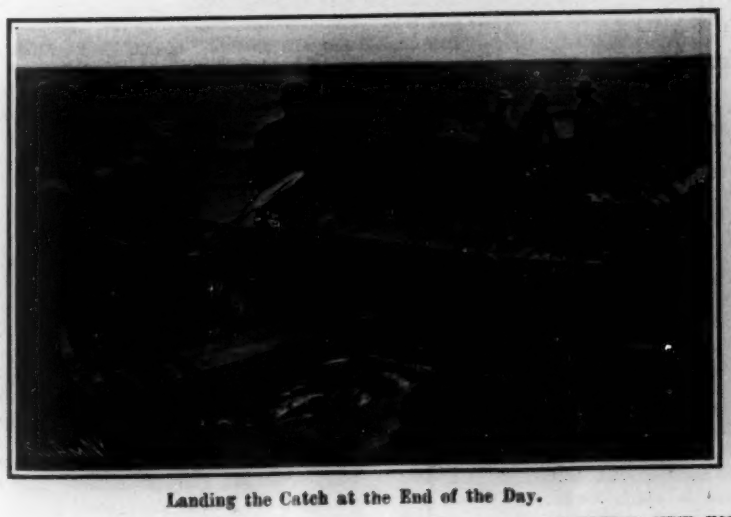
Waiting Upon the Dock to Buy Bait.

SUPPLYING NEW YORK WITH BLUEFISH.

The extent to which the bluefish catching and marketing industry has grown to-day is evidenced by the magnitude of the trade in New York city alone, where annually over 5,000,000 pounds of the catch are sold, aggregating over $300,000 in value. All along the eastern coast north of Cape May are scattered colonies of hardy fishermen, whose existence the year around depends upon the success of the bluefish season; and the growing favor with which it is regarded as a table fish, especially in the North, is constantly augmenting the numbers of these industrious and energetic toilers. The bluefish, *Pomatomus saltatrix*, is of wide distribution, and is common in summer all along the entire eastern coast of the United States. It is closely allied to the mackerel, and is found in nearly all warm seas, including the Mediterranean, but is strangely absent from British waters and from the vicinity of Bermuda and the Western Islands. It is not so well liked south of Cape May, but even in the Southern States the taste for it is growing. Little is known regarding the reproduction of the bluefish, though it is now regarded as certain that they do not spawn in-

Removing the Day's Catch from the Beach.

Running the Boat up on Shore After Landing.



Landing the Catch at the End of the Day.

Preparing to Set the Seines.

SUPPLYING NEW YORK WITH BLUEFISH.

shore. The young fish first appear in northerly waters in August, and at that time they are about five inches long. They grow with great rapidity, and by the following season have usually attained a length of from twelve to fifteen inches. Subsequently the increase in size is even more rapid, and it is said that bluefish weighing as much as twenty-five pounds have been caught off the Massachusetts coast, while eight and ten-pounders are not rare. The average weight of those taken in the coastal regions of New York, New Jersey, and New England is between three and five pounds. The fish is bluish or rather greenish in color, with a silvery underbody and a dark blotch at the base of the pectoral fin. It is one of the most voracious feeders upon other inhabitants of the sea, and represents an extremely important factor in fish mortality. Traveling rapidly in great schools, it ferociously attacks similar schools of other fish little inferior to it in size, often destroying many more of these than are required for its food, and it has been found that this excessive voracity characterizes the young as well as the old. They feed principally upon gregarious fishes, particularly the menhaden, upon squids, and upon certain kinds of marine annelids. They are sometimes found in large rivers, and, for instance, they are caught in the Hudson as far up the stream as the set of the tide is perceptible.

Between the eastern end of Long Island and Cape Cod, bluefish in great numbers are caught in weirs or pounds, and in still greater quantities in gill nets. Line fishing, especially along the New Jersey coast, is also employed, and this method is largely resorted to in supplying the New York market. When caught with rod and line the bluefish offers excellent sport to the fisherman, for not only is the prey intelligent and resourceful, but he is a game fighter as well. Hook and line for bluefishing are used in trolling, "chumming," or in heaving from the shore. A light rod with artificial minnow or shrimp bait is usually employed in catching young bluefish, or "snappers," as they are called in the South.

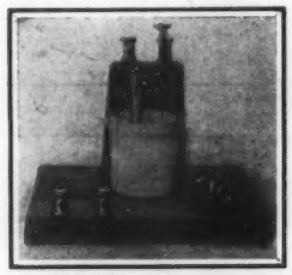
The accompanying illustrations are from photographs taken at a typical bluefishing hamlet on the Jersey coast, Gallilee near Seabright. The method here in general use is known as "chumming," though a small number of bluefish is caught by means of seines together with flounders, mackerel, and other marine inhabitants. The fishermen, who are hard-working and intelligent, use heavy surfboats not unlike large dories with square sterns. Realizing the value of auxiliary motive power, the owners of these boats have generally installed in them four or five horse-power gasoline engines, discarding the oars, and thereby relieving themselves of considerable arduous labor, and consequently having more time to devote to the actual operation of fishing. The boats leave very early in the morning, and usually return by four o'clock in the afternoon. The catch is generally sold to wholesale dealers having warehouses at the landing place or in the village, though not infrequently the fishermen themselves pack and ship the bluefish to dealers in New York. As a rule, however, they prefer to sell to the middleman on the ground, thus avoiding the trouble of packing, icing, and freighting.

The bait used along the New Jersey coast is the mossbunker or menhaden, a gregarious fish about six or eight inches long, which is found in great schools off the coast. The bait is sold to the bluefishers by men whose sole occupation is the catching and selling of the mossbunker. The latter is obtained by means of seines set on the shallows off the shore, and a large power boat is employed for gathering and delivering the menhaden for the next day's bait to the fishermen late in the afternoon after their return from the day's work. The mossbunkers are cut into small pieces, and these are used for baiting the hooks. The bait is furthermore employed in a curious manner for attracting the prey to the vicinity of the boat. Each of the boats contains a meat grinding or chopping machine—a piece of apparatus hardly to be expected in a small fishing craft—and by means of this device a quantity of the menhaden is ground up into a thick oily paste, known as "chum." When the fishing boat has been anchored upon the banks which the bluefish frequent, a quantity of the "chum" is thrown overboard, and the tide or currents slowly float it along the surface in a great widening, oily streak, known as a "slick." This at once attracts the greedy bluefish, who rush at it in large numbers, gobbling down the floating fragments and eagerly seeking bits more generous in size. These they soon encounter, but as the larger pieces are unpleasantly associated with barbed hooks, the bluefish is soon flapping vigorously but ineffectually upon the bottom boards of the boat. The fishermen, of course, exercise great care to throw out their lines within the area of the "slick," and move about from time to time as circumstances require, their anchors being rather primitive affairs which are easily raised and lowered. At the end of the day's fishing the boats are run up on the beach, often upon short wooden rollers, and a quantity of sea water is thrown into the bottom of the craft. The fish are then cleaned and washed and tossed into two-wheeled carts, by means of which they are transported to the warehouses, to be shipped a few hours later to the neighboring cities, where they are consumed.

AN ELECTROLYTIC WIRELESS RECEIVER.

BY D. L. BEARDSLEY.

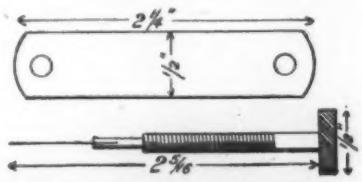
Most Hertzian wave detecters are more or less complicated, and few are very satisfactory. The writer has experimented with many kinds, and has at last evolved one which has given the utmost satisfaction, receiving the most distant messages very clearly and sharply. This detecter is electrolytic in its action, and it consists of a cell in which a zinc anode and a platinum cathode are used with an electrolyte of dilute sulphuric acid. An important advantage of this



AN ELECTROLYTIC WIRELESS RECEIVER.

receiver is the fact that it requires no battery, as it is a battery in itself.

The following are the instructions for making it: Prepare a base about 3 inches square of hardwood. At one side, parallel to the edge, erect a standard of hardwood, ½ inch thick, 2 inches wide at the bottom, tapered to 1½ inches at the top, and 3 inches high. Cut out two pieces of brass, 1¾ inches long, ½ inch wide, and 1-16 of an inch thick. One of these pieces, which will serve to support the anode, should have a 3-16-inch hole drilled at one end, and the other strip, which is to support the cathode, should be drilled and tapped for an 8 x 32 machine screw. These strips of brass are to be fastened to the top of the standard ½ inch apart by wood-screw binding posts, and should be provided with ¼-inch holes to receive the threaded shanks of the binding posts. Cut off a 2½-inch length of common battery zinc, and thoroughly amalgamate it. This may then be fastened to the untapped brass strip with an 8 x 32 machine screw, threaded into the end of the zinc. The depending end of the zinc should enter a small glass jar of about 1½ inches diameter and 2 inches high. For holding the cathode make an 8 x 32 machine screw of brass 1½ inches long with a knurled head. File down the end to a diameter of 3-32 inch, and split it with a fine jeweler's saw. Take a very fine piece of platinum wire (if Wollaston wire



DETAILS OF CATHODE AND SUPPORT.

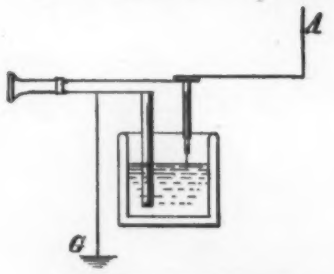


DIAGRAM OF CONNECTIONS.

can be obtained so much the better, but very fine platinum wire will do) about ¾ inch long, and place one end in the fine saw cut, after which close the kerf onto the wire by means of a vise. The screw may now be threaded into the tapped hole of the cathode-supporting strip, and screwed in far enough to bring the platinum wire within the cup. The cup should be filled with a ten per cent solution of sulphuric acid. The electrical connections may be made as shown in the diagram; the aerial being connected to the cathode supporting strip, the other strip being connected to the ground, and the two terminals of a telephone receiver being connected respectively to the two strips. Place the telephone to the ear, and feed the cathode down by turning the screw until a click is heard. This will indicate the position in which the detecter will work to the best advantage.

Tax-Freed Alcohol Assured.

The act removing the Internal Revenue tax on alcohol, passed recently by both houses of Congress, has been approved by the President and is now a law. It is expected large industries will be benefited by this legislation, and a way opened for the farmers in every section of the country to secure benefits of much utility and economy from their former waste products.

The act provides for the withdrawal from bond, tax free, of domestic alcohol when rendered unfit for beverage or liquid medicinal uses by mixture with suitable denaturing materials, for use in the arts and industries, and for fuel, light, and power.

It also provides for the establishment of registered distilleries in which the denaturing of alcohol can be done, and regulations for rendering returns to the Commissioner of Internal Revenue. Penalties are provided for violations of the act. Manufacturers are privileged under certain regulations to recover the alcohol used in any process, for use in further manufacturing. The Commissioner of Internal Revenue may employ for a period of two years additional chemists, agents, inspectors, deputy collectors, clerks, laborers, and other assistants for the prompt and efficient operation and enforcement of the law, and without compliance with the conditions of the Civil Service law. Two hundred and fifty thousand dollars is appropriated to purchase the necessary instruments, etc., for carrying out the purposes of the act.

The Secretary of the Treasury is required to make a report of the appointments and regulations prescribed, at a succeeding session of Congress, and also upon the need of any additional legislation. The act is to go into effect on January 1, 1907.

It is proposed to denature or poison the alcohol with wood alcohol, and it is expected so much of the latter will be needed for this purpose, that its production will be greatly increased.

It is believed many new distilleries will be located in the agricultural sections of the country, conveniently accessible for the utilization of the surplus grain and other products, for purposes of alcohol extraction. In large manufacturing operations the new alcohol will be of great value and utility, especially in the hat industry, where the present use of wood alcohol has proven so detrimental to the health of the employes.

The extensive use of alcohol in Germany has proven to be of much benefit. For power purposes it is found to be more efficient than gasoline, and less dangerous, while its cheapness, only seventeen cents per gallon, makes it a highly economical power agent.

The manufacturers' committee organized to promote and bring about this legislation is deserving of much praise, in the practical way the matter was brought to the attention of and pushed through Congress.

The Current Supplement.

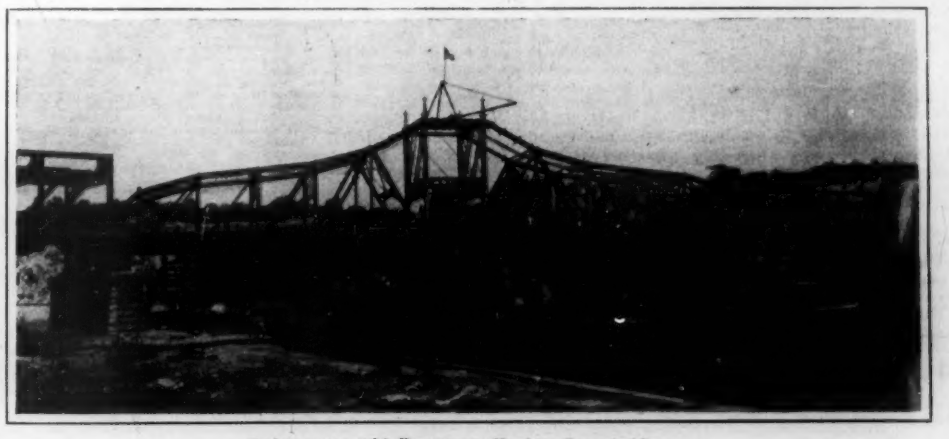
The current SUPPLEMENT, No. 1591, opens with a well-illustrated article on the "Lusitania," the new Cunarder, which has just been launched and which is the largest ship thus far designed. During the past twenty-five years engineers have applied internal-combustion motors to all manner of uses. They have adapted motors to the consumption of many different kinds of inflammable gases and vapor, and they have continually increased mechanical and thermal efficiencies, until at the present time the gas engine is competing with steam in almost every field. Dugald Clerk in a most exhaustive paper on internal-combustion motors discusses the various forms of engines which have contributed to this industrial advancement, and throws out some helpful suggestions for their improvement. How some waste materials may be utilized will be of interest to the manufacturer. The wastes treated are amber, paraffine, fur, parchment paper, and mother-of-pearl. Stanley's new system of transmitting and utilizing low-frequency currents is described. The last installment of the article on "Canals: Ancient and Modern," is published. Among the minor articles of interest may be mentioned "Concrete as a Roofing Material," "Preparation of Modern Cereal Breakfast Foods," "Influence of Light and Heat on Germination," "The Collective Intelligence of Bees," "Photographs of Projectiles," and "Oolong Teas and Their Manufacture."

Two parts of aluminium and one part of zinc form an alloy to which has been given the name "alzene." It is equal in strength to good cast iron and superior to it in the matter of elastic limit. It takes a fine, smooth finish and does not readily oxidize. The color is white. It melts at a low red heat and is very fluid, running freely to the extremities of the mold and filling small or thin parts. Great care must be exercised in melting it, particularly when mixing the two metals, in order to preserve its smooth working qualities. It is somewhat brittle and hence unsuited to such pieces as require the toughness possessed by brass. The tensile strength is approximately 22,000 pounds per square inch and 3.3 is the specific gravity. —Iron Age.

REPLACING THE BROADWAY DRAWBRIDGE WITH A NEW SPAN.

The recent transfer of the old Broadway drawbridge over the Harlem ship canal to its new quarters opposite University Heights, and the subsequent placing of the new Broadway span, affords a very interesting illustration of modern engineering methods. This exchange of bridges was made necessary to accommodate an extension of the Subway across the Harlem. The old bridge, although in excellent condition, was unable to carry the additional load of Subway traffic and the proposed trolley extension. At first it was suggested that the old draw be remodeled so that it could carry the increased loads, but it was found that the structure would have to be almost entirely rebuilt. However, a new bridge was to be constructed across the Harlem at 207th Street, to connect with Fordham Road, and it was proposed that the old span be used for this structure, and a new double-decker built for the Broadway crossing. Accordingly, the new span was built on piles at 215th Street and the Harlem River. A few weeks ago this work was done, and the piles at each side of the center were removed to make room for the pontoons on which the span was to be floated to its permanent position.

On Thursday, June 14, the old Broadway draw was lifted off its pivot and towed quietly down to the central pier of the Fordham bridge, where it was soon mounted in position. The bridge was carried on four pontoons, two at each side of the center. The pontoons were 110 feet long by 32 feet beam, with sides 9 feet high, and capable of lifting 600 tons each. The draw was partly opened, so that it could be floated away without being obstructed by the approaches. The pontoons were weighted with water and, from the decks of each pair, heavy lumber cribs were built up to the floor beams of the bridge. This was done at low tide, so that as the tide began to come in the span was slowly buoyed up by the pontoons, and to expedite matters the water was at the same time pumped out of the pontoons. The bridge was, of course, built to rest on a central support; consequently, when it was lifted off the center pier, and supported on the cribwork near the ends, the strains in certain members of the frame were reversed. For instance, the tension members at the center of the bridge were placed under compression. To prevent these members from buckling, they were stiffened with wooden beams, as may be seen in the accompanying photographs of the bridge. The draw was towed down stream by four tugs, two in front and two behind, by which it was carefully guided to the new pier nearly a mile away.



Raising the Old Broadway Harlem Drawbridge.

No difficulty and but little delay was experienced in centering the span over its new bearing. Then water was pumped into the pontoons until they lowered the span gently into place. The entire task was accomplished in just an hour. The bridge was towed to its new quarters with steam up, and as soon as it was properly mounted and the pontoons removed, it was swung to the open position under its own steam. In this position it must lie at present until the approaches are completed.

The new Broadway span was ferried to its pier on the following Saturday. The methods adopted in the two cases were precisely similar. Such tension members as were liable to buckle under the reverse strains imposed were temporarily stiffened. The bridge was also diagonally mounted on the pontoons, so that it would pass freely between the approaches. The trip up the river required but thirty-five minutes. Only one slight mishap occurred to mar the otherwise successful achievement. One of the pumps used for filling the pontoons failed to work, and as a consequence, when the span was lowered into place, one end refused to sink with the other, and the draw was tilted slightly. But this defect was soon overcome by boring a hole into the pontoon below the water line. Except for this trifling incident the entire undertaking passed off without a hitch. It was 5 o'clock in the afternoon when the span was hauled from the piles at 215th Street, and at 7:30 the bridge was open to pedestrian traffic. At 9 o'clock the work was entirely completed, and on the following morning the bridge was thrown open to public use.

The new span is 272 feet long and 39 feet wide from center to center of trusses, or 53 feet wide over all. Its total weight is 1,200 tons. The old span is necessarily of the same length and width, but its total weight, including the flooring, is only 1,100 tons. The

Towing the New Drawbridge up the Harlem River.

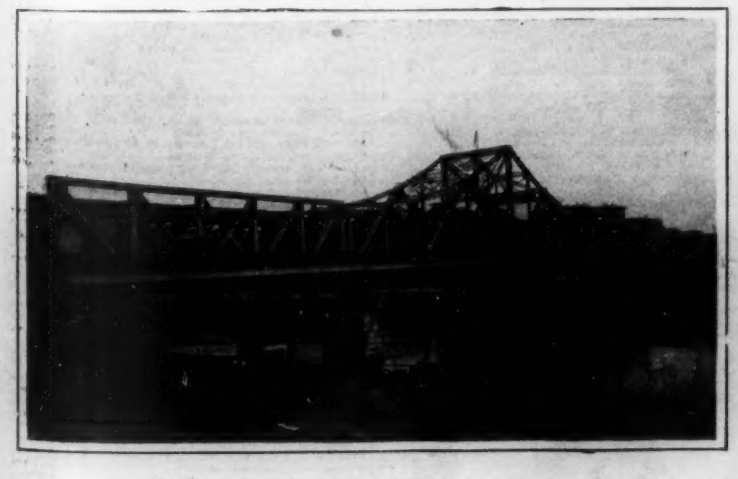
new approaches of the Broadway bridge were built on cribwork beside the old structure. The cribs were mounted on tracks, so that when the approaches were completed the old spans were removed and the new ones moved into position with a minimum of delay. The Subway tracks are now being laid on the bridge, and should be ready for use in the course of a couple of weeks. It is probable that by the first of August Subway trains will be running as far as 231st Street.

Credit for the successful transfer of the bridges belongs to Mr. Terry, of the firm of Terry & Tench, who planned the undertaking and gave it his personal supervision.

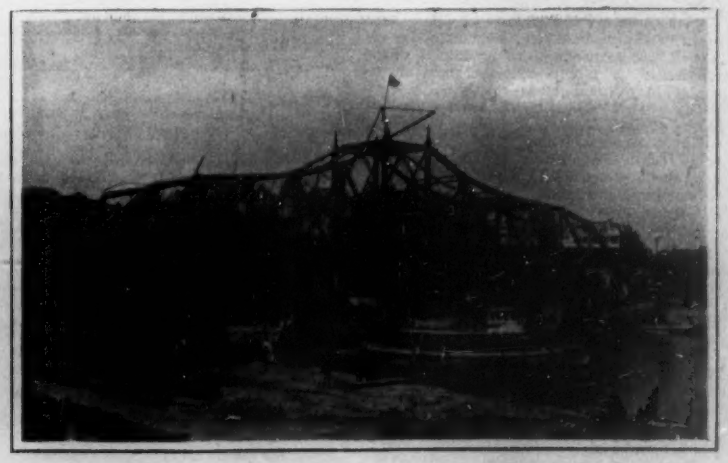
Carnegie Institution Appropriations for Retiring College Instructors.

The first selections from among retiring educators to receive disbursements from the Carnegie Foundation, organized last year by the well-known philanthropist to provide retirement pensions, or, as they are to be known, allowances for teachers in the universities, colleges, and technical schools of the United States, Canada, and Newfoundland, have recently been made by the directors of the institution. The total amount to be distributed among the fifty educators retiring at this time approximates $70,000 a year. This sum does not very materially decrease the income from the $10,000,000 in Steel Corporation bonds which Mr. Carnegie set aside for the purpose. The professors and teachers who will receive the benefit of this year's disbursement have been members of educational institutions scattered throughout the entire country. Among well-known men on the list are John Krom Rees, of Columbia; Henry M. Baird, of New York University; Hiram Corson, of Cornell; Charles A. Young and William A. Packard, of Princeton; Edward W. Morley, of Western Reserve; George Trumbull Ladd, of Yale; Henry P. Bowditch, of Harvard; Francis A. March, of Lafayette; Dr. E. R. Merrill, formerly president of Ripon College, Wisconsin, and P. H. Chandler, of Ripon.

The production of acetylene gas without water is now said to be possible, calcium carbide shaken with dry soda crystals being found to generate gas freely.



The New Drawbridge Span Located in Position.



Towing the Old Drawbridge down the Harlem River.

REPLACING THE BROADWAY DRAWBRIDGE WITH A NEW SPAN.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

REGISTERING DIFFERENTIAL - SPEED INDICATOR.—J. RICHARD, 25 Rue Mélingue, Paris, France. The invention relates to an improved registering differential-speed indicator, and is useful in the study of alternating currents and for other purposes where it is desired to measure fluctuations of speed. The displacement of the differential train is recorded and amplified, so that a slip equal to a small fraction of a revolution can be observed.

Of General Interest.

PIPE OR CONDUIT.—C. H. WILSON, Red Oak, Iowa. A pipe or conduit is employed comprising a metallic frame, around which is applied or molded concrete or other composite material of which the structure may be formed, the frame becoming thereby embedded within such material. In manufacturing sections of which the pipe is made portions of certain members of the frame at each section are left free of composite material at ends of the section, thereby enabling adjacent ends of successive sections to be united, after which further composite material may be applied to joints between sections in completion of the pipe.

COMBINED SCOPE AND DISTANCE FINDER.—T. H. MITCHELL, New York, N. Y. The inventor's object is to provide a finder for use in connection with a camera and arranged to permit the user to conveniently and quickly determine the scope of the object to be photographed and the exact focal distance between the camera and object, to allow quick, convenient, and accurate adjustment of camera according to the distance obtained, to produce a sharp focus of the object and the subsequent production of photographic views of high quality and merit.

CALENDAR.—J. N. PARKER, Bedford City, Va. The calendar comprises a series of leaflets, a suspension-board, and triangular links connecting the ends of the leaflets and the adjacent ends of the board, the apex of the links being connected to the board and the base thereof passing through aimed openings in the leaflets whereby to permit the leaflets to hang parallel. Each leaflet may be made of blotting-paper or preferably with calendered surface on one side and a blotting-surface on the other. At the beginning of each week the leaflet of the previous week is removed and used as a blotter.

Hardware.

SAW-SET.—J. F. DORMAN, East Tallassee, Ala. The inventor's object is to provide a saw-set arranged to permit of accurately setting a large number of teeth in a short time without the aid of skilled labor and insuring long life to each saw-tooth, as the latter are hammered while being set, and hence are not liable to break off or spring back to former position. The several parts can be readily adjusted to permit of setting saws of different width, thickness, shape of teeth, etc., and by using a plunger or hammer the tooth is gradually hammered down onto the anvil, so as to remain perfectly set without danger of springing back.

Machines and Mechanical Devices.

WASHING-MACHINE.—R. J. DUNGAN, 28 East Oak Street, Norristown, Pa. In this case the invention has reference to improvements in machines for washing clothing, the object being to provide a washing-machine of simple and novel construction that may be of comparatively small size, yet capable of rapidly and thoroughly cleansing the clothing.

MECHANICAL MOVEMENT.—F. N. LIVINGSTON, Ballard, Wash. The invention pertains to a new mechanism for transforming reciprocatory into continuous rotary motion, and, conversely, for transforming continuous rotary into reciprocatory motion. It is useful principally as a substitute for the crank-shaft, although it may be put to other uses, as will suggest themselves to skilled mechanics.

CALCULATING-MACHINE.—C. A. MEILICKE, Hanley, Assiniboia, Canada. The object of this invention is to produce a simple mechanism which will enable charges or accounts of different kinds to be easily computed. It is especially applicable in computing interest upon notes, but is capable of use in various connections for the general purposes stated, and when in the latter the character of the scales and tables would be changed to suit particular units of measurement or requirements.

WASHING AND SCOURING MACHINE.—R. F. E. OKRASSA, Antigua, Guatemala. The object of this invention which relates to the washing and scouring of coffee, grain, and like materials, is to provide a scrubbing-machine arranged to insure a quick and thorough washing and scouring of the coffee, grain, or other material and a complete separation of the washed material from the water or like liquid used as a washing medium.

HAT-MACHINE.—C. P. WILDENBERG, New York, N. Y. This machine is for use in supporting wires and shaping them in order to produce frames for ladies' hats. Principal objects of the invention are the provision of means whereby the several wires forming a part of a hat-frame can be conveniently and accurately supported by means of hooks even when the frame is of unusual shape, having re-entrant portions, and the provision of means for conveniently removing the frames from the machine.

Railways and Their Accessories.

AIR-SUPPLY APPARATUS FOR AIR-BRAKES.—E. B. ALLEN, Louisville, Ky. This apparatus not only keeps the air-supply up to its standard pressure at all times, but also utilizes the power in compressing this auxiliary charge as a means for stopping the train, thus securing a double effect, since the power used to oppose the stopping of the train in one instance operates through the booster-pump of the apparatus to supplement or reinforce the pressure in the reservoir for subsequent stops in the application of the air-brakes.

SLACK-ADJUSTER. — C. O. ANDERSON, Omaha, Neb. In this case the invention relates to means for automatically taking up slack which may occur in the brake-rigging of railway-cars, due to wear on the brake-shoes or other parts. The apparatus may be used on either hand or power brakes and will not interfere with the employment of the usual manually-operated slack adjustment.

STEP-HOLDER FOR CARS.—J. EDWARDS, New York, N. Y. The improvement pertains to running-boards or steps of street-cars, such as used usually at the sides of so-called "summer cars." Where such cars are operated on double tracks it is usual for the inner board or step to be turned up out of the way, this step being usually mounted upon pivots or hinge connections for this purpose. The object is to provide simple means for supporting the running-board and for holding same in folded position out of the way.

DOOR-FASTENER.—J. P. SNELGROVE, Atlanta, Ga. The fastener is especially adapted for car-doors, although it may be used upon any class of sliding doors. It obviates the necessity of cleating the door and when sealed cannot be unlocked without breaking the seal. It is easily assembled, and broken parts can be easily replaced. There is but little liability of breakage from swinging outward of the door, since in such swinging the stress will be directed outward, which stress the latch is especially designed to resist.

Pertaining to Vehicles.

WAGON-WHEEL.—I. T. HUBD, Lansing, Mich. The effect aimed at in this invention is the provision of a new and improved wagon-wheel more especially designed for use on road and farm wagons and arranged to combine strength with durability and to allow forming the wheel of wood with a hub and tire of metal.

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Inquiry No. 8189.—For makers of mail order goods.

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Inquiry No. 8190.—For makers of or dealers in magnets or loadstones of considerable power.

FOR SALE.—Water front in New York harbor with upland and riparian right. Address X. Y. Z., Box 773, New York.

Inquiry No. 8191.—For manufacturers or jobbers of a hand or tubular lantern using calcium carbide to produce the gas for fuel in same.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 8192.—Wanted, address of Follett Steel Numbering Machine Co.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools, and wood fiber products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

Inquiry No. 8193.—For machines for wall paper preparing.

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Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(10032) W. J. B. asks: Is it preferable to have all south poles on one side and all north poles on the other to work independent armatures suspended above them, or will alternate polarity, north and south, give as good results? A. We do not see that it makes any difference in which way the several armatures are connected up, so long as each magnet works by itself, as your sketch shows that it does. It is more symmetrical to connect all the same, and then in any repair you will know from what point each wire comes.

(10033) F. S. asks: 1. Is there any destructive local action in a storage battery between the oxide filling and the lead alloy of the plates? A. No. 2. Will the presence of a saturated wooden diaphragm increase or diminish the resistance to a current passing through a liquid? A. It increases the internal resistance.

(10034) B. W. L. asks: If a bridged, grounded telephone wire came in contact with one wire of a lighting circuit carrying 5,000 volts, would there be any disastrous effects to either? A. It would be very bad for the telephone. You would need to put in a new one, since there would not be much left of the old. 2. If one wire of this lighting line were to break and fall across the telephone wire, what would be the probable effect? A. If these wires were bare, the best course would be to call out the fire department immediately. In the description which you give of what took place in your case, we judge that there was no contact of bare wires, and perhaps no wires came into contact at all. The swinging of the light wire near your telephone wire would produce all the phenomena you describe; while the fact that you could get no circuit from the ground showed that the wire had not broken and fallen anywhere along the line.

(10035) J. R. H. asks: Do you have a SUPPLEMENT that treats of intercommunicating telephones and setting up and construction of same? A. We have no article giving practical details on this point. You can find various systems described in Miller's "American Telephone Practice," price $3 by mail.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending June 19, 1906.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generator, E. Fonbonne 823,677
Addressing machine, envelop and the like, J. J. Braun 823,988
Air-brake and steam coupling, automatic, Leib & Witte 824,034
Air brake, automatic, F. J. R. Wagner 823,979
Alarm lock, A. Schoenman 823,701
Amalgamator, mercurial, B. Baldwin 823,577
Animal trap, M. E. Mixson 823,736
Apron, W. H. Hatton 823,777
Aprons, automatic guide for endless, A. Bess 824,059
Automobile controlling mechanism, B. A. Gramm 823,522
Automobiles and the like, automatic circuit making and breaking device for, A. L. Riker 823,811
Baby holding and walking device, P. T. Ritter 823,812
Band clasping, S. M. Danielsen 823,994
Banjo, F. J. Bacon 823,985
Bath tub, J. A. Lefferts 823,794
Bed, J. L. Dodge 824,068
Bed and invalid's chair, combined fracture, J. T. Boyd 823,841
Bed bottom, spring, L. B. Houston 823,600
Bed clamp, F. W. Merriweather 823,800
Bed, Davenport, Kindel & Coopersmith 823,879
Bed, extensible sofa, F. M. Tinkham 823,649
Bed, invalid, W. H. Armstrong et al 824,057
Bed spring tightener, automatic, J. H. Thayer 823,824
Beet topper, J. F. Willson 824,051
Belt, driving, G. W. Parkes 823,802
Bicycle pedal crank, adjustable, B. Uhlmann 823,712
Bin. See Sliding bin.
Binder frame, W. J. Watters 823,653
Boiler flue, A. V. Walters 823,907
Boiler with superheating tubes, W. Schmidt 823,551
Boilers, chemical injector for steam, R. H. Fetta 823,941
Book cover, C. A. Johnson 823,605
Book, manifolding account, B. A. Baxter 823,755
Boot-tree and the like, F. von Essen 823,853
Bottle, H. D. Schaad 823,639
Bottle holder, R. B. Gilchrist 823,678
Bottle, non-refillable, G. R. Howey 824,018
Bottle, non-refillable, M. Loftus 824,035
Box, J. Sutherland 823,823
Box blanks, means for dampening the score lines of folding, Davidson & Wesson 823,850
Bracelet, T. W. Foster ..... 824,072 to 824,074
Brake actuating device, J. Post 823,986
Brake beam, C. F. Huntoon ..... 823,601 to 823,603
Brake mechanism, E. O. Flichinger 823,942
Brassieres, G. M. Pois 823,547
Brick, knife for striking off, Jackson & Hobbs 823,787
Bridle bit, H. Turton 823,564, 823,565
Brooches, scarf pins, and the like, safety lock for, F. Drissler 823,517
Brooder, chicken, G. S. Summers 823,902
Brush, J. W. Ferguson 823,529
Brush holder, W. L. Waters 823,569
Buckle, wrought metal, C. S. & A. S. Huntington 823,868
Building construction, Harris & Stocker 823,528
Burglar alarm, I. Watkins 823,831
Burial casket, J. D. Rensbler 823,741
Butter and fats, apparatus for melting and purifying, C. D. Monroe 823,803
Cabinet, compartment, R. W. Sturr 823,901
Calculating machine, G. H. Sears 823,897
Calculating or computing machine, J. Gruner 823,526
Calendar, perpetual, J. Guidinger 823,723
Cameras, reversible back for photographic, L. Borsum 823,759
Can drying apparatus, M. Leitch 823,731
Can loading and counting machine, J. G. Hodgson 823,781
Can loading and counting mechanism or apparatus, J. G. Hodgson 823,780
Car, combined stock and freight, E. Wyatt 823,983
Car coupling, W. Slayden 823,643
Car coupling, automatic, S. P. Bush 823,960
Car door lock, C. M. Carnahan 823,762
Car door operating mechanism, J. C. Herrmann 823,862, 823,863
Car, dump, S. Otis 823,631
Car end brace, H. W. Wolff 823,837
Car end bracing, H. W. Wolff 823,838
Car frame, railway, W. F. Kiesel, Jr. 823,790
Car grain door, L. J. Mighell 823,735
Car roof door, J. C. Herrmann 824,077
Car, stock, C. W. McKeehen 823,890
Cars, metallic underframe for passenger, A. Stuchi 824,084
Carburetter, explosive engine, J. B. D. M. Malezieux 823,608
Card, coin, F. W. Stack 823,817
Carpet fabric, C. C. Stewart 824,045
Carrier system, J. A. Suerth 823,822
Case. See Thermometer case.
Cash register, L. Cooney, Jr. 823,511
Cash register, W. G. Doty 823,516
Cash register, L. Cooney, Jr. 823,767
Casting anode plates, mold for, R. Truswell 823,977
Cement mold, W. F. McNamire 823,993
Centrifugal machine, F. Kaehl 823,948
Chair back, adjustable, M. F. Glennon 824,006
Cheese hoop, W. W. Gilmer 824,005
Cheese cutter, computing, C. D. Leader 823,689
Chest and desk, field, E. S. Sayer, Jr. 823,700
Chuck, J. Petrelli 823,545
Chuck, P. Thomas 824,085
Churn and ice-cream freezer, combined, D. D. & E. F. Mayfield 823,612
Cistern, W. O. Wayman 823,832
Clamp, F. E. Walden 823,748
Clamp, D. Swope 823,903
Clock, intermittent alarm, W. E. Porter 823,894
Clothes line reel, W. J. Connell 823,931
Clothes pin, J. M. McChesney 823,809
Clothes rack, folding, A. F. Peters 823,807
Clutch, friction, J. G. Fabio 823,753
Coats, stay-plate for, J. A. Vaughn 823,746
Cock, emergency angle, W. H. Maddox 824,036
Cock, plug, E. Hill, Jr. 823,779
Coffee roaster, J. S. Miller 824,037
Collapsible box, R. Ronconi 823,813
Collapsible box or crate, W. R. Price 823,897
Comb fastener, Smith & Stieglitz 823,555
Combing machine, cotton, wool, etc., F. W. Chadderton 823,844
Commutator, W. L. Waters 823,568
Compressors, relief device and attachment for, R. Conrader 823,845
Condiment holder, W. J. Bain 824,058
Controlling apparatus, irreversible, L. E. Remondy 823,971
Conveyer, G. Stitt 823,900
Cooker, canned goods, C. F. Gray 823,523
Copy holder, F. E. Whitaker 823,908
Copying device, H. H. Harrison 823,860
Copying, press, J. W. Ligon 823,691
Cotton elevator, pneumatic, T. S. Grimes 823,858
Cotton scraper, blocker, and cultivator, combined, W. R. Cox 824,066
Crank wheels, counterbalancing, C. T. Westlake 823,750
Crate, folding poultry, Henry & Marsh 823,945
Crate or box, folding, C. L. Dolph 823,515
Crate, shipping, F. W. Bender 823,840
Cream remover, E. S. Bartram 823,986
Crease bead guide, W. B. Mason 824,040
Cultivator attachment, A. M. Potts 823,808
Current motor, C. R. Buffington 823,695
Curtain support, window, W. P. Powell 824,042
Cycle saddle, Brooks & Holt 823,915, 823,916
Date and note block, combined, J. Schwarz 823,702
Desk utensil, J. N. Maingot 823,798
Direct acting engine, compensating, F. F. Nickel 823,694
Directory attachment, H. W. Stone 823,559
Display box, folding, C. E. Isacke 823,604
Display chest for silverware, etc., E. Herbeck 823,778
Display device, Kahn & Seigle 823,536
Display device clutch mechanism, J. W. Bragstad 824,062
Display rack, J. W. Roach 824,063
Door closer and stop, Hildyard & Drummond 823,532
Door, gable, J. F. Deardurff 823,587
Door, grain, W. S. Gilleland 823,943
Door indicator, L. D. Holden 823,782
Door mat, W. C. Richardson 823,972
Doubletrees and swingletrees, coupling for, L. Burg 824,063
Dough cutting machine, G. E. Gowdy 824,008
Dough mixing machine, J. A. Reams 823,740
Dough raiser, J. H. Kefauver 823,537
Drawer stops, tool for setting, C. T. & H. Garden 823,721
Drill. See Grain drill.
Drills or the like, support for, A. Ball 823,662
Drilling and tapping device, J. Petrelli 823,546
Drinking fountain, E. S. Richardson 823,697
Duplicating apparatus, M. J. D. Carter 823,939
Duplicating apparatus, A. B. Dick 823,937
Dustpan, H. A. Hayden 823,725
Dye and making same, disazo, T. Kroeber 823,793
Dynamometer, H. Purdie 823,895
Earth cutter and grader, D. W. Jones 823,872
Elbow forming machine, N. W. Hartman 823,688
Electric current generators and motors, collecting brush for, O. Siebers 823,642
Electric light bracket, E. F. Hug 823,533
Electric machinery, dynamo, W. L. Waters 823,566
Electric time switch, A. B. Zierleyn 824,054
Electric transmission system, C. G. Burke 823,506
Electrical receptacle and plug, Hatael & Morley 823,734
Electrolysis of water, apparatus for the, K. Kellner 823,650
Electromagnet, C. F. A. Sturtz 824,046
Elevator brake, M. Fullenlove 823,720
Elevator safety door, J. M. Porter 823,965
Emergency brake, F. B. Corey 823,932
Eraser, F. M. Burrows 823,918
Excavating and grading machine, universal, W. Gilmore 823,855
Excelsior from broom-corn clippings, making, S. K. Wilson 823,573
Extensible bracket, F. L. Demartini 823,588
Fabrics, apparatus for treating textile, West & Mauck 823,834
Fan, fly, P. F. Hodges 823,727
Fats and the like from waste waters, apparatus for the recovery of, C. Kremer 823,686
Feed water regulator, F. H. Ploutt 823,635
Feeding device, stock, M. J. Overfield 823,806
Fence, portable wire, J. M. Crawford 823,903
Fence post, J. W. Westlake 823,655
Fence post, F. M. Garry 823,722
File, wire hook bill, West & Korts 823,654
Filing case drawer support, C. Ernst 823,771
Film cartridge, A. W. McCurdy 823,624
Filter, F. Hardie 823,527
Fire alarm, Oatway & May 823,543
Floor, artificial stone, P. Langguth 823,966
Floor support for buildings, E. P. Sperry 823,580

Folding box, W. H. Richmond..... 823,810
Footwear, machine for manufacturing, M. C. Clark..... 823,927
Footwear, manufacture of, M. C. Clark... 823,924, 823,926
Footwear, manufacture of vulcanized, M. C. Clark..... 823,928
Friction set, M. B. Miner..... 823,802
Fuel feeding apparatus, H. J. Travis..... 823,563
Furnace, J. P. McLeod..... 823,902
Furnace grate, A. Cotton..... 823,715
Furnaces, fuel feeding device for boiler, J. and W. Reagan..... 823,549
Furniture, convertible, D. H. Goodrich.... 824,076
Fuse, percussion, C. L. Gulick..... 823,981
Fuse, shell, Driggs & Wilkinson..... 823,852
Game, S. F. Randall..... 823,548
Game board, R. T. Carr..... 823,507
Garment supporter, C. Chrysler..... 823,922
Gas and air for heating purposes, mixing acetylene, A. Keith..... 823,538
Gas burner, W. P. Wiemann..... 823,836
Gas generators, valve for acetylene, Higgs and Hoyoss..... 823,598
Gate, C. G. Lindsay..... 823,602
Gate and door securer, J. W. Beall..... 823,501
Gear casing, differential, E. P. Gray..... 823,524
Gear, variable speed, Wilson & Johnston... 823,658
Girder cutting apparatus, H. John..... 823,871
Glass, apparatus for drawing sheet, Colburn & Washburn..... 823,581
Glass furnaces, batch drying, heating, and feeding apparatus for, C. L. Betz..... 823,757
Glass molding machine, H. A. Dwyer..... 824,070
Governing mechanism, engine, W. L. Waters..... 823,567
Grain and seed cleaners, blast regulator for, F. J. Prane..... 823,637
Grain conveyer, pneumatic, J. M. Akers.... 824,056
Grain drill, P. M. Gundlach..... 824,010
Granulating machine, E. L. Richards..... 823,550
Grate attachment, fire, C. Dieterle..... 823,995
Grinder for cultivator disks and tools, G. B. Greene..... 823,857
Grinding machine, Miller & Howard..... 823,613
Guitar attachment, H. M. Willis..... 823,657
Gumming machine, E. A. Claus..... 823,714
Gun sight, C. O. Eckley..... 823,999
Hanger. See Smoke bell hanger.
Harness support, O. M. Carleton..... 823,761
Harrow riding attachment, L. E. Waterman..... 823,652
Harrow, rotary, C. J. Davis..... 823,933
Harvester, corn, W. E. Koch..... 823,880
Harvesting machine, beet, G. F. Conner... 823,583
Hat fastening, S. F. Egan..... 823,518
Hat frame former, G. W. Price..... 823,696
Head rest, S. Kline..... 823,792
Heating apparatus, W. Kane..... 823,686
Heating fluids mechanically, F. J. Gilroy... 823,856
Heel nailing machine, J. E. Collins..... 823,582
Hides and skins, apparatus for dyeing, Martinet & Dulac..... 823,539
Hinge, J. C. Anderson..... 823,911
Hinge and support for edgewise movable gates, combined, F. E. Knapp..... 824,033
Hoist, log, W. Bearry..... 823,502
Hoisting apparatus, J. W. Johnson..... 824,025
Horse hitching device, J. B. Plato..... 823,964
Horses, pacing device for, M. T. Bransfield 823,504
Horseshoes, antislipping device for, L. Alarme..... 823,497
Hose coupling, N. A. Christensen..... 823,510
Hot water boiler, J. B. Walker..... 823,981
Hubs of gears, etc., machine for forming key seats in, G. H. Webb..... 823,833
Ice cream freezer, H. J. Gerner..... 824,075
Illuminator, O. A. Mygatt..... 823,626, 823,621
Induction coil, S. H. Sauve..... 823,973
Inhaler and respirator, E. K. Hill..... 823,946
Ink well cover, dust proof, J. Kastner, Jr.. 823,875
Inkstand, automatic, F. M. Ashley..... 823,752
Insect trap, H. Freimann..... 823,718
Insulated coil for electrical apparatus and making the same, E. Thomson..... 824,048
Insulator, A. Biele..... 823,912
Insulator, H. M. Acly..... 824,055
Insulator, prong, L. Steinberger..... 823,820
Ironing board, G. H. Aigln..... 823,910
Ironing table, L. C. Bullock..... 823,580
Journal bearing, D. J. Llewellyn..... 823,693
Keyboard, dummy, J. W. McCann..... 823,888
Knitting machine, J. F. Sheppard et al.... 824,043
Knitting machine, rack stitch rib, Stafford & Holt..... 823,818
Ladder, C. Coplantz..... 823,512
Lamp and prismatic glass reflector, composite electrical, O. A. Mygatt..... 823,619
Lamp, electric arc, E. J. Murphy..... 823,958
Lamp, kerosene incandescent, J. A. Mathes 823,733
Lamp receptacle, electric, P. H. Jachnig... 824,021
Lantern, signal, W. A. Wright....824,052, 824,053
Lasting machine, M. Brock..... 823,664
Lasting mechanism for tacking and stapling machines, H. Walther..... 823,906
Latch, door, N. M. Hutton..... 823,786
Latch, spring, M. S. Keeler..... 824,027
Lathe for turning axles, C. Mills..... 823,614
Lathing, machine for weaving sheet, J. D. O'Brien..... 823,628
Lifting jack, W. F., P. & L. Kidd..... 823,949
Lifting, moving, and depositing materials, appliance for, J. M. Henderson..... 823,861
Linotype machine casting box, J. B. Allen 823,690
Linotype slugs, machine for cutting or shortening, R. F. Jacobs..... 823,788
Lock, B. O. Berntsen..... 823,987
Locomotive boiler, H. J. Travis..... 823,562
Locomotive, electric, E. D. Priest..823,968, 823,969
Locomotive lubricating system, C. W. Manzel..... 823,600
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THIS is a matter of great interest to the public, and of still greater interest to thousands of individuals. People with the fairest minds—and that means most people—have been disturbed and unsettled by the developments and denunciations of the past few months. What these people want is the truth—the plain unvarnished truth. To give them this truth is the object of this announcement.

The Mutual Life Insurance Company was organized in 1843, the first of its kind in America. In 24 years it had become the largest in the world. For 39 years, in spite of the keenest competition, it has held the lead, passing unharmed through panics, failures, strikes and wars; meeting with promptness its every obligation and having over 470 millions of assets to-day; this being 78 millions in excess of the 392 millions required by law as a reserve fund for paying all the Company's insurance risks, as certified by the New York Insurance Department; and all other legal liabilities.

The recent Insurance agitation was unique. The investigation certainly was thorough. As every one knows the Mutual Life was on the firing line. The smoke has now cleared away. What do we find?

In the first place we find that the Mutual Life is still the largest and staunchest Life Insurance Company in the world. Without defending or in the least belittling the abuses and extravagances recently brought to light, everybody should keep in mind the fact that the solvency of this Company has not for a moment been affected thereby. Concerning the work of the finance committee which has been attacked in the press, this Company's auditing committee consisting of Messrs. Truesdale, Auchincloss, Fish and Dixon stated on February 15th, 1906:

"The Committee certify that the investments of the Company are of the highest order and well selected," and "have found the valuation given safe and conservative, in many instances less than the market value, and in none in excess of such value."

In the next place, extravagance has been stopped, and those responsible for it have gone; a new management has been installed, and retrenchments have been affected that have already saved vast sums of money and will save much more as time goes on. Legislative reforms have likewise been anticipated, and the Company is now as sound at the circumference as it always has been at the core.

In the next place, the ending of the first quarter presents an excellent opportunity for comparing this year with last.

The amount paid policy holders is $9,608,436.50, an increase of $1,070,835.26. The receipts for premiums were $15,082,484.57, a decrease of 857,995.29 for the period. This is a shrinkage of less than 5½ per cent. The amount paid for expenses was $2,935,552.44, a reduction of $1,547,279.36.

This remarkable showing is a good thing to be kept in mind by everybody—those now insured in the Mutual Life, and those who should be. It cannot be accounted for by the smaller amount of new business written. Of the saving for the quarter, the sum of $390,961.52 is in items not connected with the obtaining of new business.

In the next place we find that this Company is doing business—more business than any other company in the world with one exception. Far from being paralyzed or demoralized it is forging right ahead. Policies by the hundred are being written each day; honest trustees, keenly alert, are directing its affairs; faithful and experienced men are doing its intricate work; loyal agents are explaining its advantages and discriminating people are obtaining its protection.

In the next place we find that there need be no question as to the future. A policy in the Mutual Life is just as good as gold. No obligation could possibly be better. A bond of the United States Government is no safer. It will, therefore, be a misfortune if any one is misled by the writer who prints for revenue or for notoriety, or by the attorney who is out for his clients, or the competitor who is out for himself, or even by the gentlemen who have organized themselves into committees under an honest misapprehension of the facts. Such incidents may tend to hinder business, but need deter no one who needs insurance.

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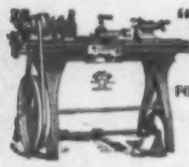

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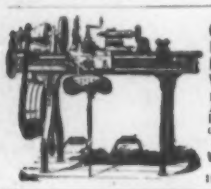

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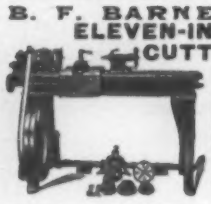

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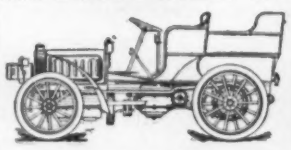

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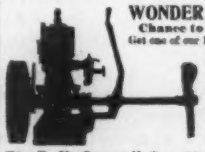

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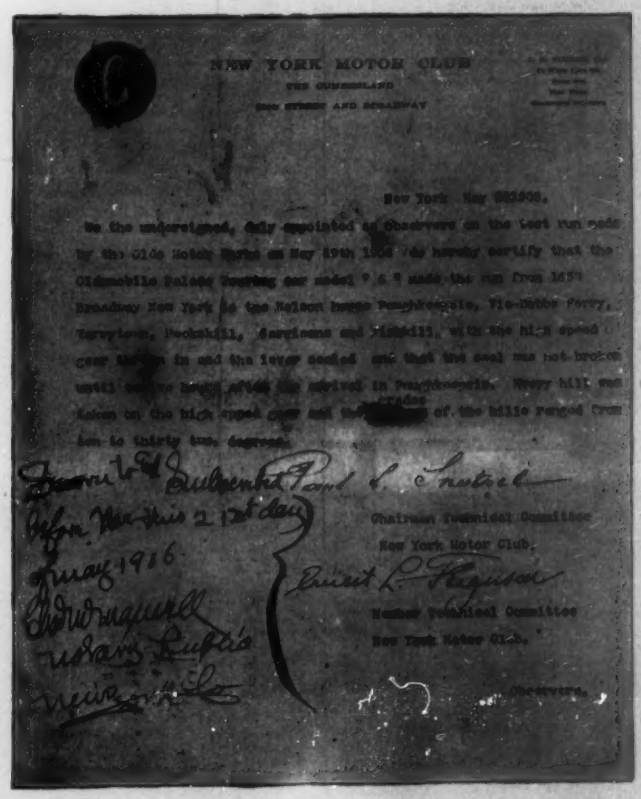

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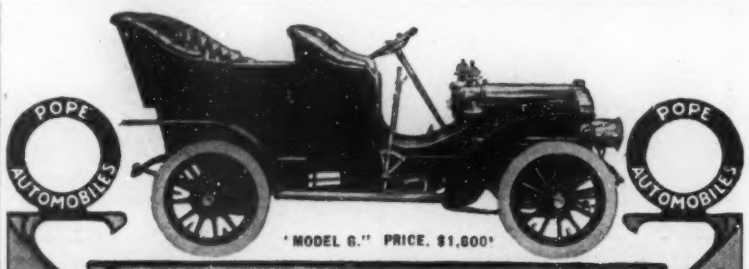

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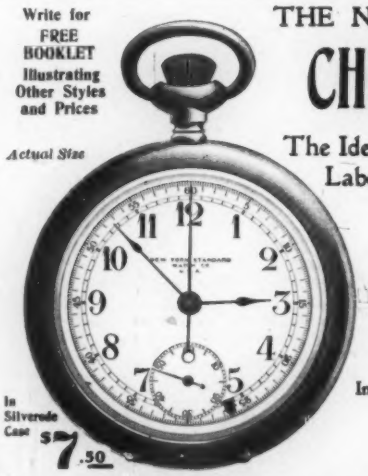

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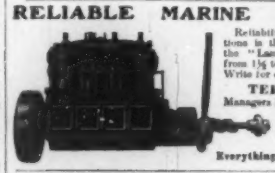

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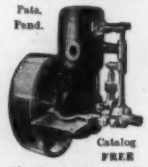

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INDEX.

ILLUSTRATIONS.

A

Aerodrome, Langley 93
Aeroplane, Danish 252
Aeroplane, Wright's 291
Aerotonon, Roman 95
Agasis, statue, in earthquake 420
Air box for stoves..... 256
Air regenerator, an..... 512
Airship, "Italia" 532
Airship, motor and basket ... 93
Airship, von Zeppelin's 194
Aluminium transmiss. line ... 229
Annunciator, improved 136
Ants, habits of 289
Aphis, rose 12
Arc discharge 92
Arches, concrete 385
Armor piercing shell 274
Armor plate vs. burglars, 321, 325
Arrow heads, shaping of 215
Auto-carte, the 155
Autograph, earth's 344
Automaton, remarkable 46
Automobile, an ice 174
Automobile race, Ormond 133
Automobile school 43
Automobile skates 301, 306
Automobile, war 228
Automobiling to South 460
Auto-propulseur, the 369

B

Ball bearing, a silent..... 34
Barrel carrier 96
Barrels, retaining device..... 372
Bas relief, cement 396
Baths, sea, artificial..... 195
Batteries, storage, charging. 148
Battleship, circular *369
Battleship "Dreadnought".. 208
Beams, concrete 385
Bi-planes, Brown's 93
Bicycle sled, Weltman's.... 153
Billiard table, adjustment... 520
Bludgeons, burglar's 89
Bluefish, supplying N. Y.... 537
Boat, gas propelled 305
Boat, hydroplane 188
Boat, motor, twin screw 193
Boats, circular 309
Boats, motor 185
Boiler, hot air..... 494
Boiler, locom., explosion.... 515
Boiler, water-tube 13
Bread-making cabinet 272
Bridge, Hudson memorial..... 361
Bridge, roller, perambulator. 519
Broiler, electric 349
Bromelia fiber 71
Brussels, Museum Nat. Hist.. 235
Buckboard, a light 27
Bus, Oldsmobile 33

C

Cabbage chopper, electric... 350
Cabinet, bread-making 292
Cable, 10,000-volt, laying.. 532
Cables, aluminium 229
Canal, lake and lock 109
Canal, Panama ...68, 69, 205, 212
Canal zone, sanitation ..214, 215
Candle making, French..516, 517
Car, auto, Marmon 29
Car, motor, Adams-Farwell... 29
Car, motor, Mercedes 33
Car, motor, Union Pacific 472
Car of dynamite, accident 236
Car, racing, Christie 472
Car, touring, Cadillac 30
Car, touring, Cleveland 32
Car, touring, Columbia 33
Car, touring, Grout 33
Car, touring, Haynes 33
Car, touring, Jackson 33
Car, touring, Oldsmobile 30
Car, touring, Rambler 33
Car, touring, Royal 32
Cars, auto, crossing Cont., 21, 24, 25
Cars, auto in fuel test ...413, 414
Cars, fastest, Florida contest. 115
Carbureter, automatic 27
Carbureter, novel 326
Cavite drydock 10, 11
Cement burning, flame in 387
Cement, art possibilities 396
Cemetery, a, in earthquake.. 418
Chain wrench 256
Chair and life preserver 176
Chair for seasickness 72
Chassis, Marmon 28
Cheese cutter, new 256
Chromoscope, diffraction 456
Clarifier, milk 492
Clothes line support 76
Clutch, Franklin 40
Clutch, friction, new 420
Clutch, wheel 38
Coal, slack, burning 210
Coaling warships 65, 68
Colorado River, overflow of, 328, 329
Columns, concrete 384
Columns, stone, boring 272
Composing machine 73
Concrete block machines .390, 391
Concrete construction 384, 385
Concrete mixing machines, 388, 389, 391
Concrete retaining wall 395
Concrete stairway 394
Concrete, armored, Oregon ... 168
Concreting a reservoir 381
"Connecticut," guns of 249
Conveyer, automatic 304
Coracle, circular 309
Cord knotter 513, 514
Corn harvester 96
Cotton picking machine..... 371
Crane, electric, 100-ton..... 500
Crane, traveling, new..... 90
Crater of Vesuvius..... 33
Crawfish, California 459
Cruiser "Tennessee" 225
Cunarder, new 265
Cylinder, gas motor, cooling 70

D

Dam, Gatun 213
Darwin, Sir Geo. H..... 363
Deck caliking tool..... 304
Depot, coal, floating 65, 68
Dinosaurs, carnivorous 113
Dish washer, electric 349
Door check, simple 13
Drafting instrument 372
Drag, burglar's 88
Drawbridge, Broadway, replacing 539
"Dreadnought," battleship .. 208
Dredges, floating, for Panama. 68
Drydock, Cavite 10, 11
Dryptosaurs, fighting 105
Dust collector 108
Dust, street, testing 108
Dynamometer, simple 155

E

Earthquake and car tracks.. 473
Earthquake, effects of 419
Earthquake recorders....498, 499
Earthquake, San Francisco, 392, 393
Eclipse of sun 145, 153
Edison, automobile trip of 460
Eggs, Easter, making 309
Electric machine, Franklin .. 351
Electric power at Niagara.... 248
Engine, motor boat 193
Engine, "Speedway" 192
Engraving steel plates 412
Eubyotuon, Roman 95
Evaporator, milk 492

F

Finger moistener 520
Fireproofing at San Francisco. 473
Flags, warship, making... 533
Flatiron, electric 349
Floor beams, concrete 168
Floor, parabolic 489, 493
Floors, concrete 394
Flying machine 129
Flying machines, foreign 252
Fog signaling apparatus 452
Foundations, construction of, 476, 477
Foundry work, puzzling bit .. 275
Franklin, Benjamin 341
Friction, clutch 420
Friction disk drive 27
Fuel, oil, south, railroads... 536
Fuel test, auto 413, 414

G

Gage, triple and butt 480
Gasoline locomotive 409, 412
Gatun dam 213
Gear, overhead 85
Generating station, bicycle .. 46
Generator, water-tube 13
Glaciers, study of.....529, 534
Gilding machine 291
Gilding machine, Lilienthal .. 93
Globe, lamp, novel..... 480
Globe, life saving 368
Golf club head 96
Gun attachment 96
Gun, Vickers-Maxim, new.... 440
Gyroscope, marine 90

H

Hadrosaurus 113
Hair drying machine 349
Hammock support 13
Handhold, electric 96
Handle for guns..... 96
Hand saw, portable 256
Heavens in April 267
Heavens in May 345
Heavens in June 451
Heavens in July..... 531
Heleropod, luminous 135
Helicoptere 129
Helicopter, Leger's 253
Horn, auto, Gabriel 36
Hospitals, electricity 44
Hudson Memorial bridge 361
Hydrogen generator 130
Hydroplane boat 188

I

Ice automobiles 174
Ignition outfit 38
Illusion, optical 489, 493
Indicator, engine 307
Ingalls Building, the 394
Inhalatorium, an 175
Insulator, pin 519

J

Jackscrew to lift safes 88
Jelly fish, large 459
Jimmies, burglar's 89
Joint, a universal 38
Joint, rail, new 156

K

"Kaiserin Auguste Victoria," 496
Keys, skeleton 89
Kite, dome, Herring's..... 93
Kite, Prof. Bell's 93
Kite, tetrahedral, Bell 324
Knife polisher, electric 349
Knotter, cord 513, 514

L

Lamp globe, novel 480
Lamp, incandes. lighting 92
Lamp, time-controlled 519
Langley, Samuel P. 207
Laocoon, group 439
Launch, electric 192
Length, standard of 209
Letter writing, ancient 312
Leveler, billiard table..... 520
Lifeboats, gasoline 233
Light, electric, for autos.... 36
Light, electric, for yachts.. 194
Lights, night 517
Lighthouse, Diamond Shoals .. 245
Lighthouse, moving a 134
Lighthouse oscillations 304
"Livadia," yacht 368
Lizards, fossils, giant 113
Lock, time, Hollar's 325
Locomotive boiler explosion. 515
Locomotive, comp. French ... 254
Locomotive, electric, an 305
Locomotive, mining 409, 412
Locomotive, Simplon tunnel .. 290
Long Island City elect. stat.. 345

M

"Macomb," snagboat 478
Machine sling, Roman 95
Mail catching device 304
Meat press, multiple 420
Meerschaum pipes 348
Messages, wireless, directing. 118
Metal, expanded 384
Milk, dried, apparatus..... 492
Milking stool 519
Mines, submarine detonations. 170
Mining locomotive 409, 412
Mixing machines, concrete, 388, 389, 391
Molecules, size of 150
Monument, a Riombamba 6
Motogodille, the 189
Motor, a 2-h.p. 26
Motor boat, twin screw 193
Motor boats 185
Motor, Frayer-Miller 28
Motor, the Knox 29
Motor, marine, two-cycle 192
Motor paddle wheel 189
Motor, polyphase 370
Motor skate 129
Motor sleigh 260
Motor, surf 480
Motor, Welch 31
Museum, Brussels 235
Music, electrical 268

N

Niagara, electric power at.... 248

O

Ore unloading machinery..125, 133

P

Paddle wheel, motor 189
Pail holder 519
Palintonon, Roman 95
Panama Canal excavation ..68, 69
Panama Canal, lock 109
Panama Canal, trip 205, 212
Paper, paraffined 517
Pedestal, cement 396
Perambulator, bridge for.. 519
Pennsylvania R.R. station, 429, 438, 440, 453
Phosphorescence in animals.. 135
Photograph, historic, a 74, 75
Photographs, diffraction color. 455
Piano making ..416, 417, 432, 433
Pier, concrete 385
Pipes, meerschaum 348
Piston rods, moving..... 518
Platinum wire, burning 92
Potato paring machine 350
Power plant, concrete 385
Power station, Pan. R.R., 284, 285, 286, 345
Power transmis. Long Isl. R.R. 479
Printing press, Franklin's ... 351
Profile tracer 308
Projectile, energy of, loss ... 190
Pump, an ejector 236
Purse, book 373
Pyrometer, thermo-electric .. 415
Pyrosoma, the 135

Q

Quarto observatory 499
Quito arc, determ. 6

R

Racer, Christie 472
Races at Ormond meet 133
Rack at Rockaway 479
Rail joint, new 156
Railway, Alpine, Murren, 160, 169
Ratchet device, new 38
Receiver, wireless, electrolyt 538
Recorder, photo, Milne's.... 498
Recorders, earthquake...498, 499
Rectifier, mercury arc 148
Reflector for lamps..... 480
Refrigerating plant 114
Regenerator, air, an..... 512
Reservoir, Jerome Park..... 381
Rhodesia, ruins in..... 232
Road indicator, auto 155
Rock cutter, Lobnitz..... 69
Rock fish, spotted..... 459
Roof, concrete 385
Rose aphis 12
Rowing shell, land..... 256
Runabout, a light 27
Runabout, 8-h.p. 26

S

Safety device auto 156
Salton basin, inundation 310, 311
Salton, inundation of....328, 329
San Francisco disaster, the, 392, 393
Sand waves, work of....172, 173
Saw, hand, portable 256
Scaffolding, improved 518
Screw flyer, Santos-Dumont's 129
Sea of Japan, photograph...74-75
Searchlight, automobile 284
Seat back, folding..... 520
Seine tunnel, the 149
Seismograph, the 344
Seismographs 498
Sheepshead, California 458
Shell, armor-piercing 274
Shingles, manufacture of.... 255
Ship, globular, a..... 308
Signaling apparatus, fog.... 455
Signs, danger, for auto..... 36
Simplon tunnel locomotive.. 290
Skate, motor 129
Skates, automobile 301, 306
Sled, bicycle 309
Sleigh, motor 260
Snagboat, Macomb 478
Snails, sense of smell in.... 371
Snakes, feeding of..... 106
Snow sculptures 42
Soldiers, mountaineer, Italy. 112
Sole for shoes..... 76
Sounding apparatus, new.... 308
Spark coil construction..... 195
Spark, electric, autograph of 92
Speedster, 10-h.p. 26
Sphere, magic 489, 493
Spider crab, giant 459
Sprinkling pot, automatic... 8
Stairway, concrete 394
Standards of length..... 209
Stars, morning and evening.. 230
Station at Tulcan..... 6
Station, geodetic, Quito..... 6
Station, Pennsylvania R.R., 429, 438
Steamship, the largest..... 496
Steel plates, engraving..... 412
Sterilization, water, apparat. 457
Stool, milking 519
Storage cell, Edison..... 94
Stoves, air box for..... 256
Sun, eclipse of.....145, 153
Sun dial, cement 526
Surgical instruments, tempered 500
Surveying, simple 495
Switches, heating 365

T

Tapers, wax 516
Taxidermy, artistic 270
Tire protector, new 215
Teeth, artificial 288
Telegrams, wireless, directing 511
Telegraphy, wireless and body 154
Telegraph, wireless, Bell.... 324
Telegraphy, wireless, Africa. 234
Telephone instrument 76
Telephone, Lorimer 437
"Tennessee," cruiser 225
Tent, novel 196
Tire, non-skidding 519
Tobogganing, water 21
Tormentum, Roman 95
Torpedo, turbine 3, 7
Touring car, Northern 34
Touring car, Peerless..... 31
Toy, novel 372
Tracer, profile 308
Transmission, Mercedes 29
Transmission, typical 27
Tree, arched, curious..... 195
Tree within a tree..... 367
Tricerators, the 113
Trick, chemical 513
Truck, auto, 16-h.p..... 33
Tunnel, Seine, the..... 149
Turbine, Parsons 128
Typesetting machine 73

V

Valentines, manufacture of.. 152
Valve, locomotive 292
Valve, Walscheart 275
Vault, armor plate 321
Vehicle, rowing, land..... 256
Ventilator, window 76
Vessel, circular, mediaeval.. 309
Vessels, sunken, marking.... 256
Vesuvius, past and present.. 331

W

Wall, retaining, concrete.... 395
Wall, training 176
War automobile 228
Watch dials, novelty in..... 155
Water sterilizing apparat.... 456
Water supply, New York's.. 250
Watering pot, automatic..... 8
Wheel clutch, automatic..... 38
Wheel lock, auto-car..... 156
Wheels, spring, new..... 36
Wimshurst machine 44
Window screen 256
Wrench, chain 256

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

A

Abbe, Prof. Ernst, work of.. 271
Academy of Sciences, Nat... 363
Acid and coiled spring exper. 9
Acid, salicylic, detection of.. 167
Aero Club, exhibit of..... *93
Aeronautical apparatus *93
Aeronautical note 136
Aeronautics, object lessons in 327
Aeroplane, Wright 40, *291
Aeroplane, Voia *252
Agricultural products, exports 411
Air, bad, detective..... 12
Air box for stoves..... *256
Air, compressed, novel use.. 365
Air, fresh, for miners..... 469
Air, liquid, effect on temperat. 454
Air, radio-activity 342
Air regenerator, an..... *512
Airship, "Italia" *532
Airship, von Zeppelin's..... *195
Airship voyage to the pole.. 270
Albumen, artificial 250
Alcohol, denatured, free..450, 470
Alcohol, indust. uses..... 545
Alcohol, industrial uses of... 514
Alcohol, tax-freed 538
Alcohol for motors, cheap... 283
Aluminium breastplates 307
Aluminium, production 135
Aluminium steels 327
Aluminium transmis. lines.. *229
Aniline in foods, detect..... 167
Animal study, new depart... 350
Annunciator, improved *136
Ant, the white 156
Ant, white, fertilising power 435
Ants and their ways..... 289
Antiquities, Roman, London. *38
Archaeology, school 13
Arches, concrete *385
Architecture, naval, curious. *368
Arc of meridian, determ..... *6
Argon and ultra-violet rays. 23
Armor plate vs. burglars.... *325
Army signaling apparatus... 283
Army transport by sea..... 86
Arrowheads shaped with wood *215
Arsenic vs. iron rust..... 23
Asbestos of Switzerland..... 329
Astronomy, new conceptions. 106
Assouan dam 510
Atmosphere, curtesia of..... 147
Atmospheric humidity, regul. *512
Atoms, electrons and ions... 266
Atoms, Lord Kelvin on..... 411
Automaton, a clever..... *46
Auto-carte, the *155
Automobile carnival 454
Automobile, electric 21
Automobile in 1906 22
Automobile, ice *174
Automobile industry in France 40
Automobile, Mercedes *33
Automobile notes...40, 459, 460
Automobile races, Ormond.. *133
Automobile school, an *435
Automobile show and carnival 439
Automobile shows, displays .. 87
Automobile, sight-seeing 520
Automobile speed, new *115
Automobile statistics 304
Automobile trip round world. 494
Automobile, trip of an..... *24
Automobiles, war *228
Automobiles, Rambler *52
Autos, area in Germany..... 154
Automobiling to the South..*460

B

Ball bearing, silent *34
Balloon ascensions, record... 303
Banana, essence 150
Barium, iodo-mercurate 451
Barrel carrier *96
Barrels, retaining device....*372
Baths, sea, artificial..... *195
Battery, storage, Morrison.. 38
Batteries, storage, charging.*148
Battle, modern, life risk in. 282
Battleship "Dreadnought," 166, *208
Battleship "Dreadnought," guns 518
Battleship "Kearsarge," disaster 342
Battleships, uniformity in... 323
Beam bending machine..... 8
Beams, concrete *384
Beaufort Sea, exploration of 207
Bees, insects and flowers.... 155
Behring sea tunnel 282, 367
Billiopsagin 207
Bicycle generating station... *46
Bicycle shed, Weltman's..... *509
Bicycles, motor equip..... *26
Billiard table adjustment... 520
Birds, soaring of..... 287
Blindness, color, curability.. 498
Blood, coloring matter..... 174
Bluefish, supply, N. Y..... *537
Boat, gas propelled, Rhine.. *305
Boat, glass bottomed *458
Boat, house, motor 29
Boat, motor, torpedo *190
Boat, motor, twin-screw *193
Boats, hydroplane *188
Boats, motor, hydroplanes for 211
Boats, motor, speed of..... 187
Boats, power, light..... *191
Body as a power generator.. 176
Body, resist. to auto accidents 471
Body ventilating apparatus.. 480
Boiler explosion, locomotive. *515
Boiler, hot air..... *494
Boiler pressure and superheat 146
Boiler, water tube *13
Books, eating of..... 267
Boomerang, lecture-room 451
Branson, J. L., death of..... 518
Bread-making cabinet *292
Breadstuffs, exports of..... 411
Breastplates, aluminium 306
Bridge, chain, Manhattan... 246
Bridge, Hudson Memorial... *366
Bridge, Manhattan, delay, 126, 246
Bridge, roller, perambulator. *519
Broiler, electric *349
Bromelia fiber *71
Buckboard runabout *27
Buildings, wooden, S. Francisco 495
Bullion refining, electric 87
Burbank, recent experiments. 130
Burglary, art of..... *89

C

Cabbage chopper, electric... *350
Cabinet for bread making... *292
Cable, 10,000-volt, laying.. *532
Cables, X-ray test of..... 89
Caffein in coffee..... 107
Caisson disease, cause..... 510
Calcium carbide in Europe... 307
Calendar, perpetual 495
California fruit 435
Canal by lake and locks..... 109
Canals in India..... 323
Canal, lock, Barton plan ... *109
Canal, lock high level..... 188
Canal, N. Y., Brockton, Boston 303
Canal, North Sea 346
Canal, Panama 206, 410
Canal, Panama, excavation .. *68
Canal, Panama, lock..... 530
Canal, Panama, problem..... 535
Canal, Panama, schemes 66
Canal, Panama, trip through. *212
Canal traffic, Europe 150
Canal zone sanitation *214
Canals, electricity for 411
Cancer in mice, studies on.. 471
Candle making, French..... *516
Car, Berliet, in America..... 35
Car, motor, Adams-Farwell.. *29
Car, motor, four-cylinder *29
Car, motor, speeds, Florida.. *115
Car, motor, Union Pacific... *472
Car of dynamite, accident to. *237
Car, racing, Christie *474
Car, touring, Cadillac *30
Car, touring, Cleveland *32
Car, touring, Grout *33
Car, touring, Limousine *31
Car, touring, 4,000 ..... *52
Car, touring, Marmon *28
Car, touring, National *54
Car, touring, Northern *34
Cars, auto, Decauville 56
Cars, Franklin *40
Cars, autos, in fuel test..... *414
Cars, auto, in Holland 414
Cars, auto, White 55
Cars, motor, energy test..... 511
Cars, spring wheel, contest.. 367
Cars, steel, in subway fire.. 480
Cars, touring, high power.... *72
Cars, touring, Oldsmobile *30
Carbureter, automatic ..*27, *326
Cargo, a strange 327
Carnegie Inst., appropria... 539
Carpet, a new 520
Carpet industry of Persia.... 11
Carrier pigeons, price of.... 216
Castor oil, a derivative of.. 23
Catgut strings 411
Cavite drydock *10
Cement, artistic possibil.... *396
Cement burning, flame in.... *387
Cement, caseine 187
Cement drain tiles, washed.. 131
Cement manufact., government a 382
Cement, manufact. in U. S.. 455
Cement, Portland, facts about 470
Cement tiles again 251
Cereals, waste of 91
Chair and life preserver..... *176
Chair for seasickness..... *72
Chain wrench *256
Channel, English, crossing .. 154
Channel tunnel, the 322
Charcoal powder, hot 303
Chauffeur, genesis of..... 396
Chauffeur, foreign 174
Cheese cutter, new 256
Chime, stone, Chinese..... 91
Chimney, steel, largest..... 500
Chinatown in China 210
Chocolate foreign products... 413

Chromoscope, diffraction 455
Circuit, auto, European 307
Circus attractions, scientific. 270
Clothes line support *76
Clutch, adjustable *420
Coal deposits of America. 409
Coal, slack, burning *210
Coal tar dye industry 236
Coaling war ships *68
Cocoas, foreign, prod. in.... 411
Cod liver oil, freezing 171
Coiled spring problem 71
Coke in Germany 514
Cold, blessings of 42
Cold, greatest, place of 5
Color blindness, curability of 408
Colorado River, overflow of.. *328
Columbus, concrete *284
Columns, solid rock, boring.. *272
Combustion, mechan, equiv.. 175
Comet, Brooks, New 130
Comet, Halley's, return of.. 474
Comet, new 270
Composing machine, new *73
Compound, a new *253
Conceptions, bewildering 171
Concrete, applications of 471
Concrete, armored, construction *384
Concrete and stone masonry. 536
Concrete block machines..... *380
Concrete building blocks..... 415
Concrete, fireproof qual..... 382
Concrete, how to make..... 387
Concrete masonry, use of.. 479
Concrete mixing machinery.. *386
Concrete piles 400
Concrete retaining wall..... *395
Concrete, reinforced..... *108, 385
Concrete stairway *394
Conduit system, curb 520
"Connecticut," guns of *249
Conveyer, automatic *304
Cooling gas motor cylinders.... *76
Copper refining, electrical.... 66
Copper silicide 90
Cord knotter, the *513, *514
Corn harvester *96
Cotton, exports of 411
Cotton picking machine..... *371
Crane, cable, the 171
Crane, derrick, 100-ton *515
Crane, traveling, new *90
Croton reservoir, the 86
Croton Valley, water divers. 131
Cruiser "Tennessee" *230
Cruisers of French navy..... 515
Cunarders, new *270
Cunarders, screw propelled.. 91
Cup, aeronautic, Internat.... 420
Curb conduit system 520
Curie, Prof., death of..... 347
Current, ocean, course of..... 67
Cylinders, motor, cooling.... 171
Cylinders, wooden 174

D

Dam, Assouan 510
Dam construction, Panama.. 209
Dam for Lake Erie 127
Dam, Gatun 206
Dam, high, Salt River 274
Darwin, Prof. Geo. H..... *263
Date finder, mental 405
Deck calking tool *304
Depot, coal, Boating *98
Development, photo., proc.... 275
Dinosaurs, carnivorous *113
Disaster, courage in 302
"Discovery," voyage of..... 107
Diseases of wild animals.... 350
Disease, prevention of..... 382
Dish washing, electric..... *340
Dock, the highest 150
Door check, simple *13
Doremus, Prof. R. O., death of 270
Drafting instrument *372
Drawbridge, Broadway, replace *530
"Dreadnought," armament of 515
"Dreadnought," the ...166, *208
Drop, whistling vibration.... 363
Drydock, Cavite *10
Dryptosaurs *113
Dust, atmospheric *108
Dust, decomposition of..... 287
Dynamometer, simple *155

E

Earthquake and car tracks.. *473
Earthquake at Mr. Burbank's 435
Earthquake at Napa..... 474
Earthquake, effects of *418
Earthquake, loss to science by 387
Earthquake observations..... *418
Earthquake proof construct.. 542
Earthquake recorders, European *408
Earthquake, San Francisco, 347, *392, 471, 474
Earthquake, some features of the 383
Earthquakes *344
Earthquakes and dam construc. 366, 367
Earthquakes and steel construct. 454
Earthquakes, miner's theory 475
Easter, date of 271
Eclipse, solar, 1905 ..... *153
Eclipses, solar, artificial.... 415
Edison, automobile trip of.. *460
Edison works, the 292
Eels and electric light..... 282
Egg, poison of an 8
Eggs, Easter, making..... *308
Eggs, poisonous effects..... 114
Eggs, some costly 67
Electrical notes 94
Electrical plant, the largest. 211
Electric device, prize for.... 127
Electric discharges, high pot. *92
Electric machine, Franklin's. *351
Electric power at Niagara... *248
Electric road, Jungfrau..... 94
Electricity as anaesthetic... 227
Electricity for canals..... 411
Electricity in hospitals..... *44
Electricity, novel use of..... 349
Electro-technical industries... 68
Electrons, atoms and ions... 266
Engine, auto, as a brake..... 214
Engine, gas, efficiency 247
Engine, marine, "Speedway".. *192
Engine, motor boat *193
Engineering notes 8, 150
Engraving steel plates..... *412
Escalator patent decision.... 91
Esthytonon, Roman *85
Evolution, experimental 167
Expedition, Arctic, Mikkelsen's 207
Expedition, Sladen Trust.... 167
Expedition, Wellman 514
Explorations 107
Eyes of animals, the..... 168

F

Farms, wealth of our..... 4
Fever, intermittent, gentian in 287
Fever, typhoid, in N. Y..... 479
Fever, yellow, and mosquitoes 9
Finger moistener *520
Fireproof construction 495
Fireproofing, at San Francisco *473
Fire shield, a 518
Fishes in supersaturated water 88
Flags, warship, making..... *533
Flatiron, electric *340
Flies, destruction of..... 189
Flies, dried, as bird food..... 327
Floor paneling *483
Floors, concrete *385
Flotilla, submarine, British. 302
Flour, milk *492
Fluid lenses 471
Flying machine, prize for.... 170
Flying machines 375
Flying machines, foreign .. *252
Flying machines, new..... *129
Flywheel accident 150
Fog signaling apparatus..... *452
Food, condensed, new..... 250
Food, new ideas about..... 72
Food, pure, law, need of..... 491
Foreshore protection 146
Foundations, construction of. *476
Foundry work, a puzzling bit. *274
Franklin, bicentenary of..... 86
Franklin, scientific work of.. *350
Friction clutch, new..... *420
Fritz medal, award of..... 108
Frost, a change of..... 206
Fruit, amelioration of..... 5
Fruit, California 435
Fruit, preserving, new method 351
Fuel consumption, auto..... 307
Fuel, saw mill refuse as..... 290
Fuel, the, automobile ..382, *414
Fuel, oil, south, railroads.. *536
Fungi, study of 154
Furnace, glass, electric..... 146
Furnaces, blast, in U. S..... 288

G

Gage, triple and batt..... *480
Gas engine, Capitaine 5
Gas engine efficiency 247
Gas engine, refractory lined. 171
Gas engines for elec. generat. 474
Gas, hydrogen, process..... 5
Gas, motor cylinders, cooling *70
Gas pipes, paper 435
Gas, producer, for power.... 227
Gasoline electric train..... 431
Gasoline locomotives *412
Gatun dam 206
Gear, traveling, overhead. *90, 171
Generator, hot air *404
Generator, water-tube *13
Gentian as cure for malaria 287
Gentianmerina 287
Glaciers, study of *534
Glass, fusion of, electric.... 146
Glass manufact, elect. furnace 67
Glidden trophy tour 307
Gliding machine *291
Globe, lamp, novel *480
Globe, life saving *368
Glue for linoleum 389
Gold bearing pyrites 215
Gold, distillation 186
Golf club head *96
Grand Prix for automobiles. 511
Graphite, artificial 66
Grapnel, chain cable 146
Guide rails for subway..... 246
Gun attachment *96
Gun, automatic, McLean..... 9
Gun, Vickers-Maxim, new...*440
Guns, high velocity 362
Guns of the "Dreadnought". 515
Gyroscope, marine, in use.. *90

H

Hair-drying machine *349
Hair, thickness of 5
Halley's comet, return of.. 474
Hammock support *13
Handhold, electric *96
Handle for guns *96
Hand saw, portable *256
Headlight, trolley car..... 510
Heat, non-conductors of..... 490
Heavens in February 87
Heavens in March 187
Heavens in April *207
Heavens in May *343
Heavens in June *451
Heavens in July *531
Helicoptere *129
Helicopter, Leger's *253
Heliotropism, animal and plant 207
Hill climbing tests, auto.... 454
Horn, auto, Gabriel..... *36
Hosiery, seamless 519
Hospitals, electricity in..... *44
House painting, develop..... 293
Hudson memorial bridge..... *506
Humidity, regulation of..... *512
Hybridization of plants..... 5
Hydraulic plant, Lucerne.... 154
Hydrodynamics, hypothesis... 127
Hydrogen gas process..... 5
Hydrogen, generator *130
Hydrogen, generating, process 431
Hydroplane boats *188
Hydroplane, theory of..... *207
Hydroplanes for motor boats. 211
Hydrosaurus, the *113

I

Ice automobile *174
Ignition battery, Witherbee.. 57
Ignition outfit, dash *38
Illiterate, number of 290
Illusion, optical, apparatus.. *493
Indicator, engine 307
Indicator, road, auto..... 420
Ingalls building, the..... *394
Ingot, steel, large..... 214
Inhalatorium, the *175
Injection of trees 440
Insulator pin *519
Inventing, art of..... *513
Invention, infl. on industry.. 518
Inventions, oddities in, Inventions, valuable, two..... 12
Inventors, association of..... 521
Ions, atoms and electrons.. 266
Irrigation in California..... 457
Iron alloys, manufacture of. 67
Iron, cast, vs. wrought, for pipes 150
Iron supply, the world's.247, 475
Iron, wrought, for pipes..... 211

J

Jamestown celebration 327
Japan, copy of inventions in. 89
Japan, electric installations. 95
Japan, navy of 470
Jerome Park reservoir..... *206
Joint, rail, new *156
Joint, universal, new..... *38

K

"Kaiserin Auguste Victoria" 496
"Kearsarge" disaster 342
Kinetograph view, a curious 271
Kitchen, electrical *349

L

Lagging, magnesia for 9
Lake Erie, dam for..... 127
Lake Titicaca, navigation... 150
Lamp, electric, for autos.... *36
Lamp globe, novel 480
Lamp, time-controlled *519
Langley, S. P., death of..... *207
Lascaux group, the *439
Launch, electric *192
Lawyers, advice to..... 230
Lead a form of radium?..... 226
Legumes, commercial cult.... 227
Length, standards of *269
Lenses, fluid 471
Letter, open, to mayor..... 287
Letter writing, ancient *312
Leveler, billiard table..... *520
Lifeboats, gasoline *233
Light, a standard of..... 211
Light, blue, as anaesthetic.. 227
Light, electric, for carriage.. *56
Light, electric, for yachts.. *194
Light measurements, unit for 91
Light, standard of 271
Lighthouse, Diamond Shoals. *251
Lighthouse, moving a..... *134
Lighthouses, oscillations *304
Lightning flashes, duration.. 246
Lightning stroke *108
Linoleum for floors..... 389
Lining for engine cylind..... 191
Lock, time, Hollar's..... *325
Lock, wonderful, a 326
Locomotive, Amer., efficiency 430
Locomotive boiler explosion. *515
Locomotive, comp., French.. *254
Locomotives, gasoline *412
Locomotive performance, comparison 302
Locomotives, electric *305
Locomotives, new valve on.. *275
Locomotives, single-phase 4
Long Island City power sta.. *345
Long Island R.R. transmission *478
Lubricating ships' bottoms.. 9
Lye, concentrated 215

M

"Macomb," snagboat *478
Mail catcher, railway *304
Malaria, gentian for..... 287
Manhattan bridge 246
Manhattan bridge delay..... 126
Mantle, self-igniting 366
Marine, merchant, the..... 86
Meat preservation 450
Meat press, hand..... *420
Meerschaum pipes *348
Messages, wireless, directed. 430
Messages, wireless, directing *110
Metal, expanded *384
Metals, action on iron..... 23
Metals, ductile, tempered.. *500
Metals, slow distillation..... 147
Metals, precious, extract. of 520
Meteorological summary..34, 127, 274, 366, 387, 474
Metric system, the 66, 454
Mica, Canadian 347
"Michigan," construction of. 286
Microbes 67
Microphone transmitter 215
Milk, act. mineral subst. on 136
Milk, dried, new process..... *492
Milk preserver, water as..... 173
Mine dust explosion 480
Mines, detonat. by sound.... *170
Mines, immun. from earthquakes 535
Mining locomotive, a..... *412
Mint, old, discovery of..... 304
Mixing machines, concrete. *388
Molecules, size of *150
Money of savages..... 42
Monuments, cemetery, earthquake proof 535
Mosquitoes and yellow fever 9
Mosquito extermination 323
Moss, Iceland, edible..... 412
Moth and the flame..... 207
Motive force, human..... 211
Motive power, superintendents 8
Motogodille, the *180
Motor boats, hydroplanes of 211
Motor boats, speed of..... 187
Motor car statistics 363
Motor car, Union Pacific.... *472
Motor for hammocks 480
Motor, Frayer-Miller *28
Motor, Knox *29
Motor, marine, wo-cycle.... *192
Motor, polyphase, construction *370
Motor skate, the *129
Motor sleigh *269
Motor, surf *480
Mountain sickness 5
Mountaineers, soldier, Italy. *111
Museum of Nat. Hist., Brussels *234
Music, Chinese 91
Music, electrical *268
Music, opera, following..... 286
Musk, odor of..... 11

N

Name, what's in a 246
Napa, earthquake at..... 474
Naval programme, British... 491
Navigation, aerial, military. 322
Navigation, aerial, Wright's. 307
Navy, Japanese 470
Navy, Russian, rebuilding.. 410
Niagara, electric power at.*248
Niagara Falls, preserve..... 271
Niagara Falls, protection of. 322
Niagara problem, the..... 271
Niagara River, diversion of. 226
Niagara, saving 171
Nitrates, electric production. 306
Nitrogen perox. on ammonia. 411

O

Ocean races for small boats. 490
Oceanography, discoveries in. 147
Odors in subway, to prevent 251
Oiler, lubricating, re-mill.... 12
Omnibus, Oldsmobile *54
Onager, Roman *95
Orchid seed, germination of. 115
Ordnance, Roman *95
"Oregon," passing of the..... 4
Ore unloading machinery... *131
Oysters ordered by telephone. 509
Ozone apparatus, new..... 8

P

Paddle wheel, motor, a.... *189
Pail holder *519
Pain and inflammation..... 343
Painting, durability in..... 332
Painting, house, develop... 283
Palitonon, Roman *95
Panama Canal 410
Panama Canal, Bates plan. *109
Panama Canal, excavation... *68
Panama Canal, sanitation... *214
Panama Canal, workmen.... 435
Panama Canal, trip through. *212
Panama, earthquake problem. 206
Panama, opinion from 362
Panama, past experiences. 206
Panama, present conditions. 450
Paper gas pipes 435
Paper, rush 254
Parachutes, lesson taught by 151
Park, Queen Victoria 391
Patent cases, decisions in.. 202
Patent extension bill..... 267
Patents, brief notes on, 13, 76, 480, 520
Patent department notes, *13, *256, *480, *518
Patents, extension 507
Pearl, Mississippi 23
Peat, wood from 415
Pennsylvania RR. station, *438, *453
Perambulators, bridge for... *519
Phosphorescence in animals. *135
Photograph, hist., Japan Sea *74
Photographs, diffractive color *455
Phototegy 275
Photometer, a centigrade.91, 191
Photometer, mercury, a..... 327
Physicians for railroads..... 330
Piano making *416, *432
Plate mill, new type of.... 517
Pierce, in the trophy test.. 511
Pigeons, carrier, price of.... 215
Pigeons, carrier, orientat... 531
Piles, concrete 400
Pipe galleries in subway..... 66
Pipe, steam, covering a..... *404
Pipes, gas, paper 435
Pipes, meerschaum *348
Pipes, wrought iron..... 211
Plant hybridization 5
Plants, crossing of..... 5
Plate mill, patent 312
Plating on paper 210
Polar airship expedition.... 514
Pole, north, in airship..... 270
Polypeptide 250
Postal rates, foreign, lower. 455
Potato-paring machine *350
Power production, future of. 91
Power station, floating... 302
Power station, Penn. Railroad *285, *345
Power transmiss. Long Isl. RR. *478
Press, meat, multiple *420
Pressures, effect on body.... 510
Printing for the blind..... 493
Profile tracer *308
Projectiles, speed loss of.. *190
Propeller design 8
Propulsion of waterways..... 9
Pulse, earth's, feeling..... *344
Pump, centrifugal, patent... 272
Pump for driven wells..... *236
Pump piston rods, moving.. *518
Purse, book *372
Pyrometer, thermo-electric.. *415
Pyrites containing gold..... 215

Q

Quart measure in pint pot. 266
Quartz apparatus 170
Quito arc, determination..... *6

R

Race, auto, Cuban 170
Race, Vanderbilt cup 307
Races, auto, Ormond *133
Races for small boats..... 490
Racer, Christie, new, the.. *472
Radium emanations 303
Radium, heat evolution 166
Radium, lead a form of..... 226
Rail joint, improved..... *156
Rail, third, effect of snow.. 362
Railroad, great, electr. equip. 322
Railroad, Pennsylv., extension *285
Railroad speeds 151
Railroad, Tehuantepec 410
Railroad travel, speed in... 146
Railroads, safety on..... 71
Railway, cable, gravity..... *160
Railway construction, Germany 42
Railway, Murren 287
Railway service, Italian..... 267
Railway, Simplon, traction.. *290
Railways in India 327
Range finder, British, new. 190
Ratchet device, Thomas.... 38
Rays from radio-active elem. 303
Reader, an old, word from.. 9
Receiver, wireless, electrolyt. *538
Records, preservation of.... 434
Recorders, earthquake *408
Rectifier, mercury arc..... *148
Redwood in San Fran. fire.. 530
Redwood, fire resistance of. 475
Reflector for camps..... *480
Refraction determinations.... 107
Refrigerating plant *114
Refuse destructor, New York's 303
Regulator, water-feed *420
Relics, Roman, discovery of. 72
Reptiles, fossil, giant..... *113
Reservoir, concreting *386
Reservoir, Croton, the..... 86
Reservoirs, west., and Croton dam 530
Resin, manufacture of..... 431
Respiratory power, limits... 414
Retrograde step, a 362
Rhodesia, ruins in *231
Ribbon, measuring 450
Ride, army, new 343
Riveting with pneum. hammers 229
Road indicator, auto *155
Rock columns, boring *272
Rock salt vs. radium rays.. 236
Roofing, concrete *385
Rope, little friend of..... *12
Rowing vehicle, land *257
Rubber from bark 128
Runabout, a light *26
Runabout, 4-cylinder *27
Rush paper 254
Rusts of cereals 71

S

Safes, fireproof, salving 434
Safety device, auto *156
Sainte Claire tunnel, electrifying. 146
Salton basin, inundation *310
Salton Sea, overflow of..... *328
San Francisco earthquake, 347, *392, 470, 474
San Francisco notes 434
Sand waves, work of..... *172
Sandling tracks, device for. 15
Santa Rosa, earthquake at. 435
Saw, hand, portable *256
Sawmill refuse as fuel..... 290
Scaffolding, improved *518
Scales, computing, manufact. 195
Science, Amer. Academy of. 363
Science notes ...5, 23, 67, 107, 147, 167, 227, 271, 303, 411
Science, teaching in schools. 151
Screw dyer, Santos-Dumont's. *129
Sea erosion, protection vs... 146
Sea life, forms of *458
Sea of Japan, photograph.. *74
Searchlight, automobile *284
Seasickness, chair for..... *72
Seat back, folding *520
Secrecy in processes..... 490
Seeds and susp. anima..... 530
Seine, tunnel under *140
Seismograph, the *344
Seismographs, European *498
Shale fields, Australian..... 67
Shell, armor-piercing *274
Shell, rowing, land *256
Shield, fire, a 518
Shingles, how made *254
Ship construction, experim.. 8
Ship subsidy bill 166
Ships, globular *398
Ships, lubrication of....91, 211
Shipbuilding in United States 86
Shipping bill in a nutshell.. 226
Shock-absorbers, auto..... *40
Shops, a tour of the..... 127
Siberia, traffic with 477
Signaling apparatus, army.. 283
Signaling apparatus, fog... *452
Signs, danger, auto *36
Silver, German 169
Simplon railway, traction on *290
Simplon tunnel open 150
Sixty miles an hour on water. 187
Skate, motor *129
Skates, roller, motor..... *306
Skin friction of ships 171
Sled, bicycle, motor..... *269
Sleigh, motor *269
Smell in animals *371
Smell, why do we 11
Snag boats, Southern..... *478
Snails, sense of smell in.309, *371
Snakes, feeding of *195
Snoring, prevention of..... 76
Snow sculptures *42
Soil, earching with nitrogen 520
Soldiers, mountaineer, Italy. *111
Sole for shoes *76
Sorotchte, cause of 5
Sounding apparatus, new.... *308
South Pole, to the, by auto. 227
Spark coil construction..... *194
Speed trials, auto, Florida.. *115
Speed, trial and sea 362
Speedster, a light *28
Sphere, magic, the..... *493
Spiders, maternal love..... 327
Spiders, long fasts of..... 80
Sponge mattress industry.... 107
Sponges, vegetable 350
Spontaneous combustion 435
Spraying liquid, sanitary 134
Sprinkling pot, automatic... *8
Spring, coiled, problem..... 71
Stage lighting, method of.... 414
Stairway, concrete *394
Stairway, traveling 90
Stars, morning and evening. *230
Stars, why they seem rayed. 471
Starting device, auto..... 170
Station, Pennsylvania RR., *438, *453
Steam jacketing investigations 491
Steam, superheated for railways 410
Steamship, largest *406
Steamships, big, of the world 270
Steamships, turbine 167
Steel plates, engraving..... *412
Steel, tempering of 228
Steels, aluminum 327
Steels from scrap 66
Stellar universe in miniat.. 367
Sterilizing apparatus, water. *456
Stockings, seamless 519
Stone blotting pads 454
Stone chime, Chinese..... 91
Stone, philosopher's, modern. 283
Stool, milking *519
Storage cell, Edison *94
Stoves, air box for *256
Streets, sea water for..... 175
Strontium, the metal 227
Subway extension, Broadway 254
Subway, heat of 131
Subway ventilation 342
Sun, heat of, utilizing..... 520
Sun, eclipse of 1905..... *153
Sun, eclipses, artificial 414
Sun, temperat. of..... 536
Support, machine, elastic.. 194
Surgical instruments, tempered *500
Surveying, simple method.... *495
Switches, heating *368

T

Tanks, water, on buildings. 405
Tar, manufacture of..... 431
Taxidermy, artistic *272
Teeth, artificial, how made. *208
Tehuantepec railroad 410
Telegrams, wireless, directing *116
Telegraph, wireless, litigation 287
Telegraph, wireless, troubles 510
Telegraph, wireless, messages 430
Telegraphy, wireless, Africa. *234
Telegraphy, wireless, army. *46
Telegraphy, wireless, Bell.. *324
Telegraphy, wireless, body in. *154
Telegraphy, wireless, decade 490
Telegraphy, wireless, recent. 229
Telegraphy, wireless, station 26
Telephone instrument, new.. *76
Telephone, Lorimer *437
Telephone, sociological effects 500
Telescope, little friend of..... *12
Tempering gold, silver, etc. 500
Temple of Onias, Egypt..... 410
"Tennessee," cruiser *230
Tent, a novel *196
Test, Coupe d'Or 494
Test, economy, auto..... 494
Textiles, adulteration of..... 147
Theater, fireproof, model.... 477
Theater stage lighting..... 414
Theories, apropos of 107
Thermo-dynamics, second law 67
Tiles, cement 191, 251
Time signals, electric light. 191
Tin plate trade in Wales... 150
Tire, non-skidding *519
Tire protector, new *215
Tire road test, a 58
Tire, Swinehart 57
Tires, inflation, proper..... 40
Tires, Morgan and Wright.. 55
Titicaca, lake, navigation... 150
Tomato disease in England. 211
Tool room, efficient 342
Tormentum, Roman *95
Torpedo boat, motor *190
Torpedo boats, naval..... 286
Torpedo, turbine, new..... 87
Tour, Glidden, rules for.... 494
Touring car, Darracq 56
Touring car, Peerless *31
Toy, novel *372
Tracer, profile *308
Traction, direct current..... 22
Trade of U. S. with Europe. 253
Trade mark law, amend..... 363
Transmission, electric, long. 282
Train, gasoline electric..... 431
Train markers 13
Trains, electric, for Simplon 190
Trainsheds, big, end of..... 500
Transmission, Mercedes 290
Transmitter, European *498
Trap, wireless, curious *155
Tree growing within another. *367
Tree growth, strange 151
Trees, injection of..... 440
Triceratops, the *113
Trick, chemical *23, 8
Trophy, Herkimer, west.. 494
Truck, four-wheel drive.... 56
Truck, 16-18 horse-power.... *54
Tunnel, Behring Sea....282, 367
Tunnel construction, French.. 186
Tunnel, East River, defects. 450
Tunnel, English Channel... 127
Tunnel proposals, two 226
Tunnel, rapid transit..... 430
Tunnel, St. Clair, electrifying 146
Tunnel, Simplon 130
Tunnel under the Seine....*149
Turbine blades 75
Turbine for locomotives..... 5
Turbine, Parsons *128
Turbine, steam, designing... 22
Turbine, steam, economy, 226, 302
Turbine torpedo, new *7
Turpentine, manufacture of. 431
"Two-gallon" auto contest. 347
Typesetting machine, new.. *73

U

Umbrella sheds 500

V

Vacuum apparatus, unique.. 451
Valentines, manufacture of. *152
Valve, exhaust, locomotive. *292
Valve, the Walschaert *275
Vanderbilt cup race, play.. 170
Vaults, armor plate *325
Vehicle, rowing, land..... *256
Vehicles, commercial....85, 256
Veneer cores, utilization..... 415
Ventilation, subway 342
Ventilator, window *76
Ventnor Beach, race, auto. 307
Vesuvius *330
Vessels, British, old, sale of 482
Vessels, sunken, marking... *256

W

Wall, retaining, concrete.. *394
Wall, training a..... *176
War automobiles *228
Warning, a timely 246
Waste product, a 415
Watch dials, novelty in.... *155
Water as milk preservative 73
Water, color of 190
Water famine in New York? 106
Water-feed regulator *420
Water, mercurial, formula.. 151
Water power at high pressure 4
Water, spring, radio-activity 271
Water, sterilization *456
Water supply, N. Y....126, *250
Water supply legislation.... 246
Water tanks on buildings... 495
Watering pot, automatic.... *8
Waterspout in France, a..... 107
Wheat, strength of 324
Wheel blocking device, auto. *156
Wheel clutch *38
Wheels, spring, new..... *37
Windage, power absorbed by 255
Window of the sea, through. *458
Window screen *236
Wireless litigation 287
Wood and concrete construct. 455
Wood, artificial, from peat. 415
Wood, preservation of..... 200
Work, standing and seated 350
Wrench, chain *250

Y

Yachts, small, ocean race... 490

Z

Zapon 459

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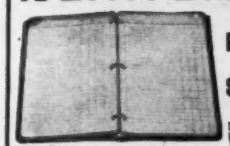

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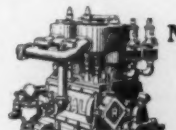

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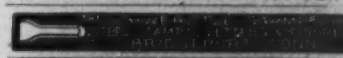

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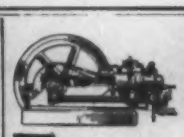

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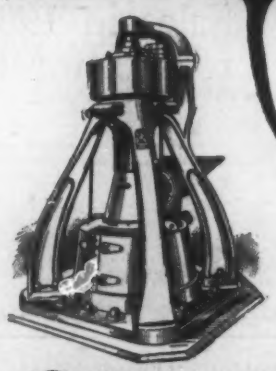

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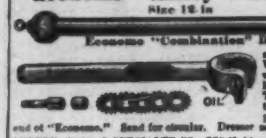

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